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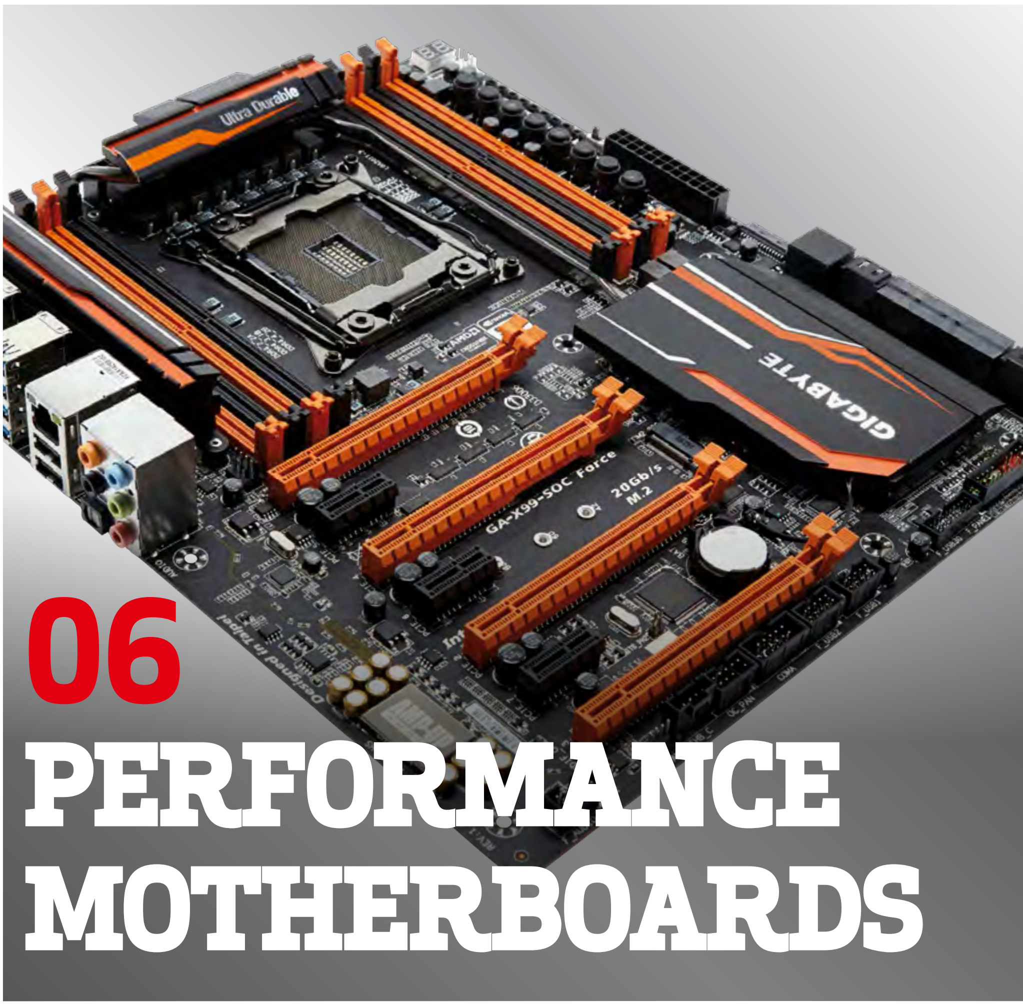

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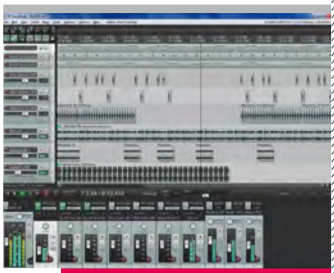

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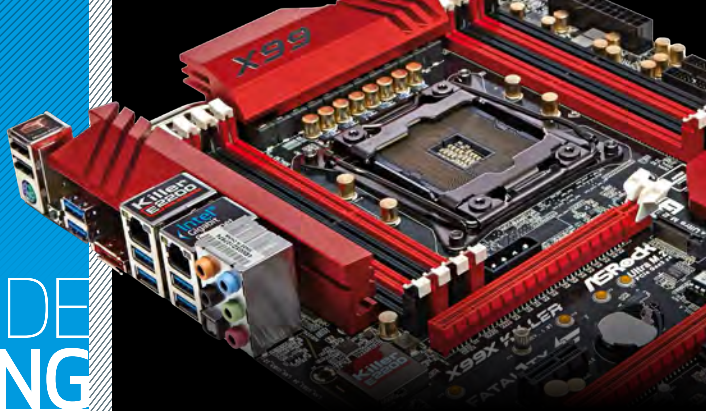

TOO MUCH TEMPTATION

'Tis the time of giving, receiving and craving tech

We regularly find ourselves roundly cursed by some readers. Mostly in a jokey, 'aww, you guys…' kinda way and mostly because we're constantly tempting you lovely people with the latest ultra-desirable hardware we find passing through our testing labs. As we near the holiday season though, we find our loved ones getting more generous, and we're more willing to splash the cash ourselves too. So, now is the time to figure out exactly what you really want to find under the Winterval tech-tree this year.

Which is why this month we've put together a dream PC gift guide, covering the perfect components and peripherals to make any tech-head weep. It's not the kind of £10 gadget tat you'll find clogging up the intermawebs throughout December, but the sort of serious PC hardware you deserve.

We've got a host of other high-performance picks this month too, with a beefy X99 motherboard grouptest featuring £160 bargain boards all the way up to £300 pro-overclocking monsters. There's also the ultra-widescreen 21:9 U3477Pqu monitor, which has given us the most dramatic gaming experience since *The Last Starfighter*.

We'll also put the first next-gen Nvidia Maxwell laptop through its paces, show you how to get streaming your games like a pro, and even help you create your own theme tune to go with it using Reaper. And, cos it's Christmas, there's a bevy of gaming delights too. So, what are you waiting for? ■

Alan Dexter
Editor
alan.dexter@futurenet.com

PERFORM
MOTHERB

INTEL'S X99 PLATFORM IS THE MOST ADVANCED CONSUMER MOTHERBOARD RANGE IN EXISTENCE, BUT WHAT DOES THAT MEAN TO US, AND WHAT'S ON THE HORIZON? **DAVE JAMES** INVESTIGATES

As the leaves began to brown on the trees, kids began fearfully counting down the days until the end of the summer holidays, and their parents' spirits lifted at the thought of shoving their little darlings back into the welcoming bosom of the education system, Intel released its latest chipset to warm all our hearts. The high-end X99 platform is the most advanced on the market today, and offers a genuine step up from the 'Extreme' class Intel chipsets that came before it.

With support for its first eight-core consumer chip, quicker PCIe-based storage connections and the debut of DDR4 in the desktop, there's nothing that can keep up. That's what a high-performance motherboard gives you: access to the very latest technologies and the power to use them effectively. It's high-end class hardware done right, without compromise.

But the trickle-down effect always leads to those new technologies filtering into boards further down the line. So, although the pricey ol' X99 motherboards are the only places you'll find the pinnacle of processing and memory technologies right now, that won't be their only home for long.

Waiting for that trickle to become a torrent though can be frustrating, so having a bead on when we can expect the mainstream to catch up with the high-performance boards is eminently useful. And that's what we're here for – to keep our ears to the ground, mobo manufacturers on speed dial and not letting an engineer go unharassed.

Over the next few pages we'll find out what's next for the motherboard, when we can expect to see the finest parts of the current top-end in the mainstream, and finally figure out what the best performance motherboard is on the market right now.

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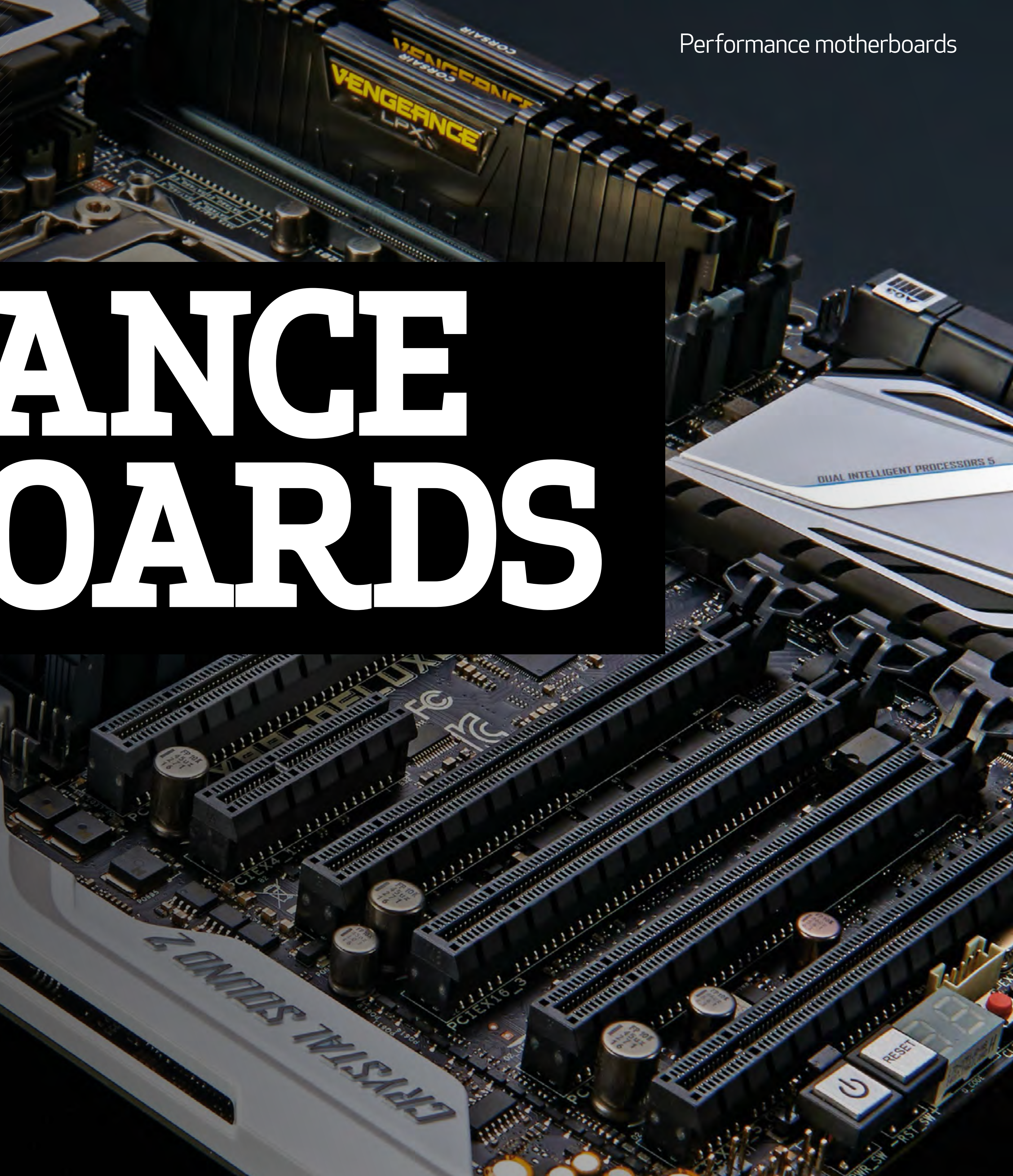
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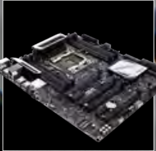
ASRock X99M Extreme4 **p10**

ASRock Fatal1ty X99X Killer **p11**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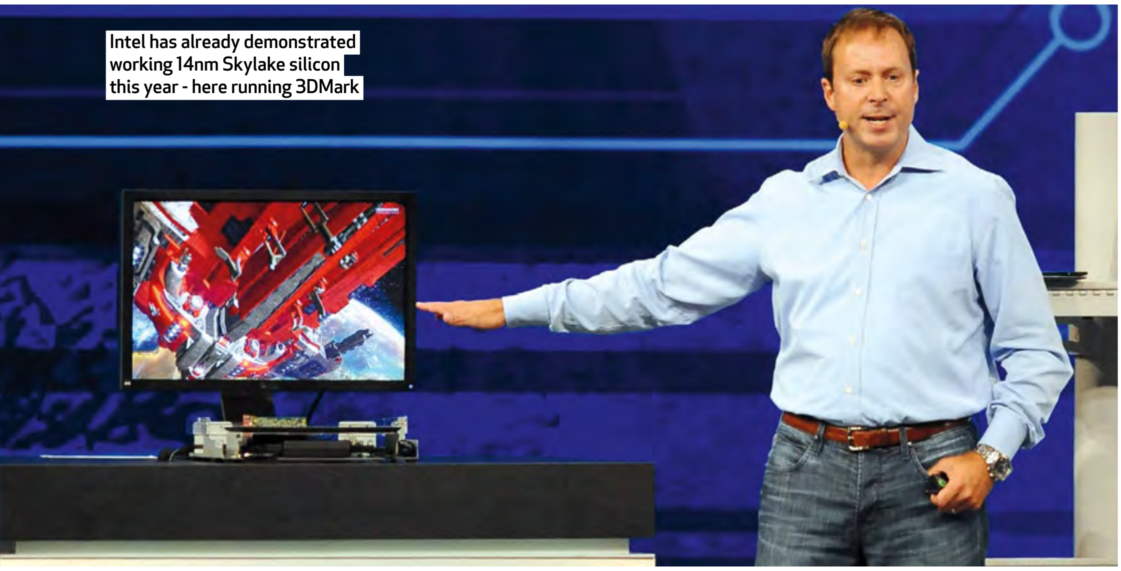
Gigabyte X99-SOC Force **p15**

MSI X99S SLI Plus **p16**

DDR4 is the next step in performance memory, only available X99 so far



Intel has already demonstrated working 14nm Skylake silicon this year - here running 3DMark

Aside from everything else, a motherboard is the determining factor in what family of processor you can build your PC around. So, as advanced as quad-lane M.2 and quad-channel DDR4 are, it's the fact that X99 motherboards have access to the top of Intel's CPU tech tree that really sets them apart. The Haswell-E processors are the most powerful consumer chips around, with the i7-5960X offering eight 22nm Haswell cores and 16 threads all capable of running at 4.4GHz.

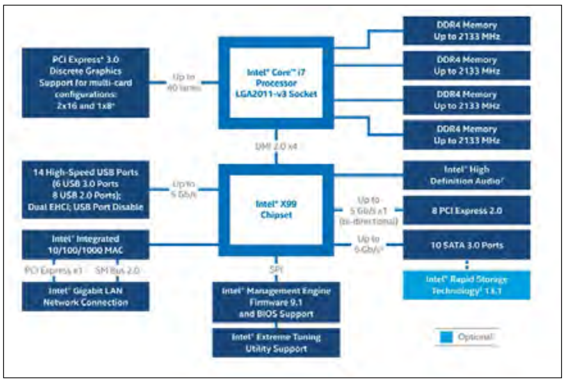
That top-end CPU also has a full 40 lanes of PCIe 3.0 connectivity, which means the fact that the X99 has only eight PCIe 2.0 lanes itself isn't an issue. That extreme PCIe support means the Haswell-E platform is the ideal candidate for a high-end multi-GPU gaming rig. With that number of PCIe lanes, you can comfortably have a pair of graphics cards running at full x16 speeds, with a third card hitting x8 performance. The increase in PCIe-based storage means your multi-GPU options are cut down if you opt to use either the M.2 or SATA Express connections though.

The introduction of DDR4 memory may not be as intriguing right now as the ability to house an octo-core CPU, but it's a necessary step in our PCs' evolution. We know that DDR4 will eventually be coming down to the mainstream boards, but it's also worth knowing where it came from.

As advanced as the X99 platform is, it wasn't created in a vacuum. Its main design features have come from the server space, with the Haswell-E processors mostly being revisions of Intel's latest Xeon range. The server space is where the low power, high-performance and high-density DDR4 really makes sense, and having it running in quad-channel mode offers a huge amount of bandwidth to servers.

Mainstream memory

We expect to see DDR4 memory drop down into the mainstream arena with the launch of the Intel 100-series chipsets, potentially next year. That's the LGA 1151 chipset that will accompany the 14nm Skylake CPUs Intel announced would be arriving in the second half of 2015. Whether we'll actually see *desktop* Skylake in 2015 is still uncertain; Intel may well follow the Broadwell line and only release limited mobile SKUs for the holiday period, then follow up with a full CPU launch in 2016.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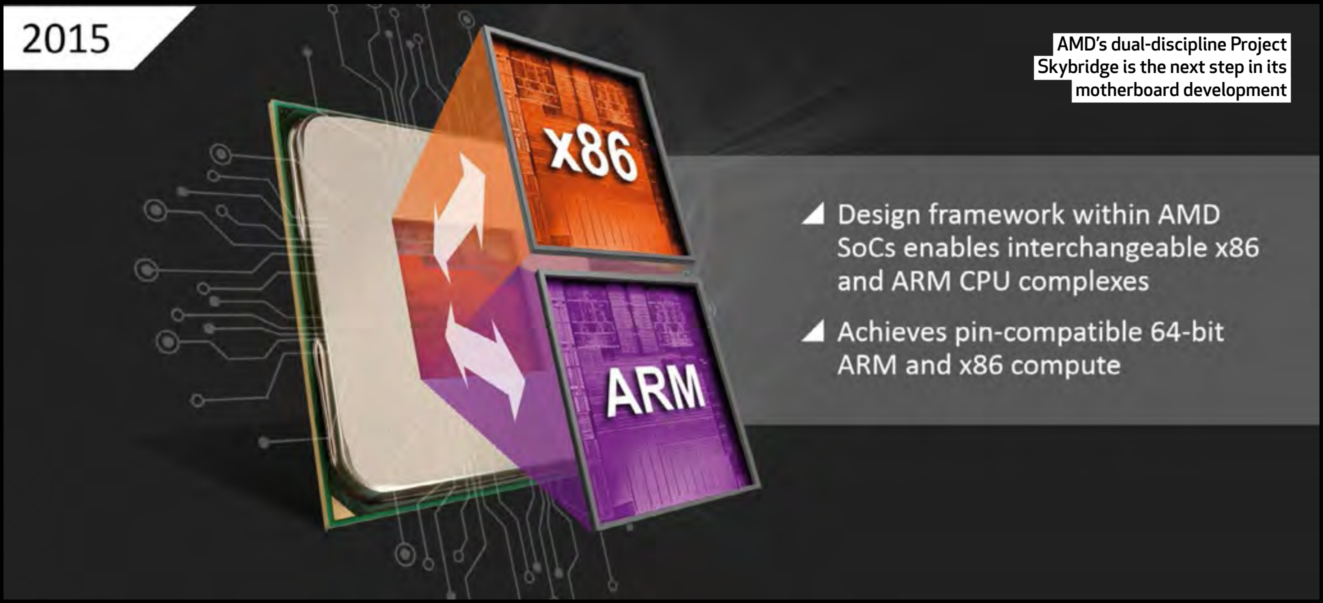
The X99 chipset is the most advanced to date

That said, there are slides floating around that have both Skylake and Broadwell desktop chips sharing the premium and mainstream processing duties for next year.

Interestingly, Skylake will be capable of supporting both DDR3 and DDR4 in dual-channel configuration – the mainstream machines arguably don't need the bandwidth of quad-channel RAM – so we'll see separate 100-series motherboards with different memory technologies. On the DDR3 side that's running at a standard 1,600MHz level and with the DDR4 versions operating at the same 2,133MHz as the X99 platform.

The top Skylake chipset will be the Z170, with the H170 as the

2015



- Design framework within AMD SoCs enables interchangeable x86 and ARM CPU complexes
- Achieves pin-compatible 64-bit ARM and x86 compute

AMD's dual-discipline Project Skybridge is the next step in its motherboard development

AMD meditation

"What about us?" comes the cry from AMD, standing Michael Jackson-like, facing down a wind machine against a billowing smoky backdrop. It's quite telling that there hasn't really been a need to include AMD in all this talk of performance motherboards so far, mostly because it has chosen to cede the high end to Intel. With Jim Keller, of Athlon64 fame, back at AMD and in charge of chip development, that could be set to change in a few years' time.

AMD's last performance mobo chipset, the 990FX, came a long time ago and doesn't look like it'll be replaced before 2016. That's when AMD's next-gen x86 Zen processor design is set to materialise. According to reports, AMD plans to ditch the clustered multi-thread design that denoted the Bulldozer architecture in favour of a more traditional simultaneous multi-thread layout. That would probably mean a drop in core count from the current eight-core maximum, but likely a boost in performance too.

That's all we know about its next architecture, though given the timings we wouldn't expect AMD to get anywhere past the 20nm production process for Zen. However, the chipset backing its new CPU architecture up must be able to match Intel in feature set, or nailing relative performance wont be the only struggle.

But the next big step for AMD's motherboard chipset is going to be the ambidextrous computing initiative, Project Skybridge. The ambitious goal for Skybridge is to produce a pin-compatible board to house either a Puma+ x86 CPU or an ARM Cortex A57 chip. Those Puma CPU cores are the next step on from the current Jaguar cores in the latest consoles, so we wouldn't expect to see the sort of high-end feature set that would bring DDR4 to AMD's lineup.

That is likely to be the dubious honour of the Carrizo APU, the follow up to Kaveri. Ostensibly it's meant to be pin-compatible with Kaveri and so will supposedly be a drop-in upgrade for an FM2+ system, but we'll need new mobos to allow us to access the DDR4 memory controller in Carrizo and plug those sticks in.

second tier of the consumer side. Aside from running with different potential memory configs, the other interesting factor with the 100-series is that the chipset itself will be transitioning to PCIe 3.0, and the Z170 will offer a full 20 lanes on top of what the Skylake CPUs will bring to the table. The H170 has fewer, but still has twice as many lanes as Z97.

With support for the same x4 M.2 connections you get with the X99 boards, those extra PCIe lanes could potentially make the Z170 platform the true dawn of PCIe-based storage for the mainstream.

In the mean time...

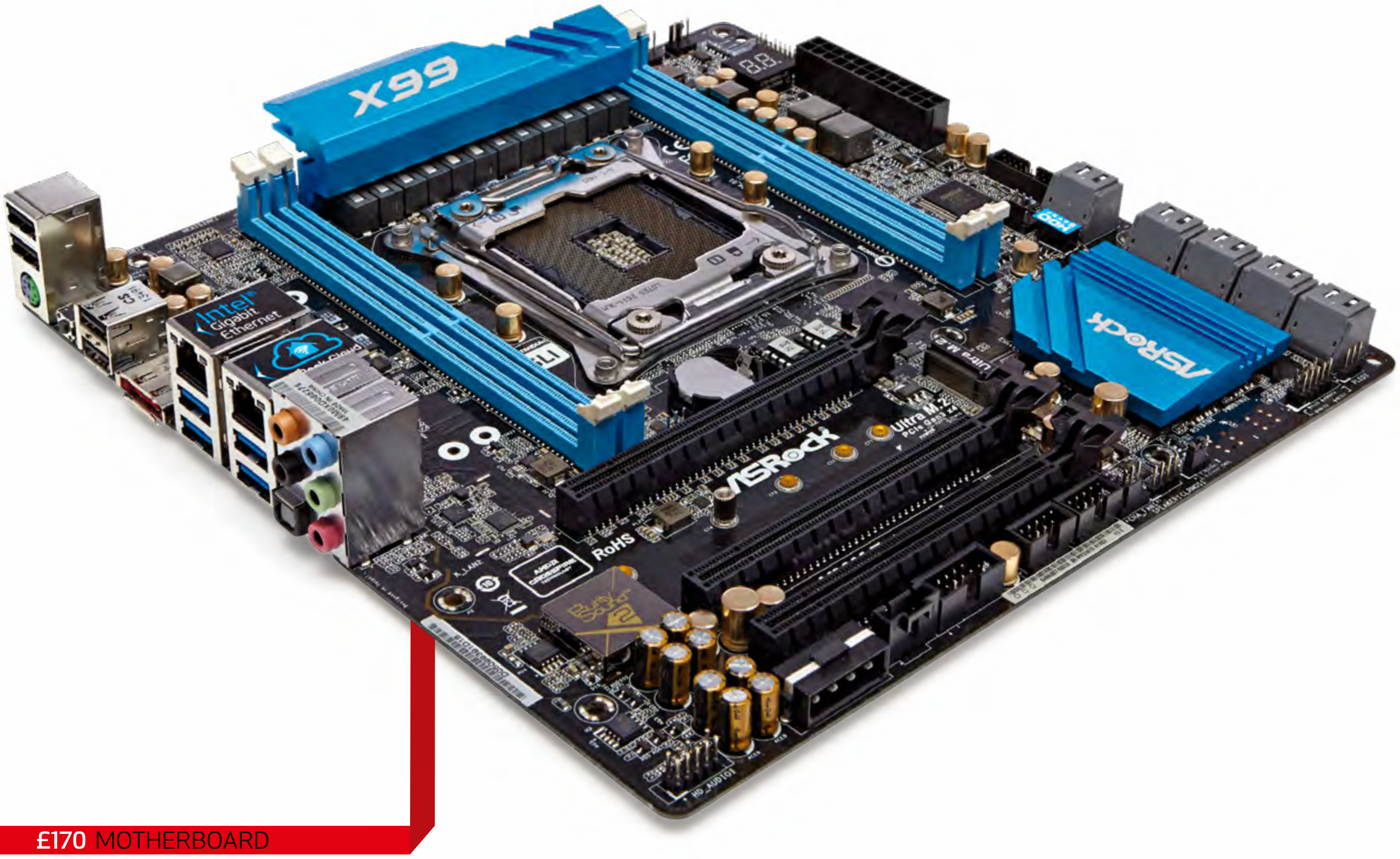
But that's another CPU generation down the road. The next chip on the horizon is the ill-fated Broadwell 14nm die-shrink. The production delays on the Broadwell design have truncated the next-gen CPU's life expectancy. We're not talking mayfly here, but given Haswell will have been around for almost two years by the time we get hold of our Broadwell chips, we're looking at Replicant-like shortened lifespans. Which is why we've already had the Broadwell chipset on fire off the shoulder of Orion. The Z97 debuted with the Devil's Canyon Haswell refresh and will remain in place until the 100-series comes along with Skylake.

It's a similar situation with the next-generation Extreme parts. Broadwell-E could arrive at the same time as Skylake's desktop chips, with a purported launch in early 2016, but will continue to use the same X99 chipset we've grown to love with Haswell-E. Details for Skylake's Extreme edition chips grow hazy as they're so far away, but they'll come with an X100-series (X190?) chipset. But all we've heard so far about that is they'll potentially come with a new revision of the PCI Express interface, Gen 4.0.

Beyond Skylake is Intel's die-shrink tick, currently code-named Cannonlake, which will take the production process all the way down to a miniscule 10nm. That's less than half the scale of the diminutive Haswell lithography. The 200-series chipset is set to accompany it, and is likely to cement DDR4 as the only memory architecture in play. Intel is believed to be fitting out its CPU manufacturing facility in Israel to cope with producing the processors on the 10nm node, and is expected to put that into operation in 2016.

That's what the future looks like for our performance motherboards, but there are lots of great options around right now. And with the impressive six-core Core i7-5820K having such a reasonable price tag, the X99/Haswell-E platform is within reach of us normal folk and offers a genuine reason to upgrade beyond the standard Haswell i7. We've gathered the best of the current crop of X99 motherboards over the page to see which ones deserve our praise and your cash. ■

PCIe-based storage is the future of performance solid state drives



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GPU support Quad AMD CrossFireX/ Nvidia SLI (only through dual-GPU cards)
Memory 4x DDR4 DIMMs
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Back panel 4x USB 3.0, 4x USB 2.0, PS/2 combo, eSATA, 1x Intel LAN, 1x Atheros LAN, Audio I/O

Last month we had EVGA's X99 Micro gracing our centrefold, and we were excited about the prospect of getting X99/Haswell E power in a diminutive form factor PC. Sure, it was missing some of the features we'd like to see in a full X99 mobo, but space was at a premium so that's forgivable. And then ASRock tipped up with its X99M Extreme4, which has soundly trounced EVGA's micro effort.

This is a bona fide X99 board with practically none of the compromises we saw in the X99 Micro, and some seriously impressive performance metrics to boot. In fact, the price and performance of this board mean we wouldn't be considering it for its mATX stature alone – we'd rather build a performance PC out of this than some of the full size boards we tested this month.

If you wanted to fashion a checkbox with the desired X99 feature set, all you'd be leaving blank would be the bit by support for eight DIMM slots for your funky new DDR4 memory, and maybe the box by SATA Express. If you're being seriously picky and have a vast array of USB devices you need permanently plugged into your rig, then you could maybe have a whinge about the relative paucity of USB ports on the back panel too.

Realistically those are minor niggles – if you can afford to populate all eight DDR4 DIMM slots in the full scale Asus X99 Deluxe then you can likely afford to buy a seriously high-priced motherboard too. And we're yet to be convinced any one manufacturer is ever actually going to make a SATA Express drive either.

But the X99M Extreme4 has it where it counts, with multi-GPU support in two full x16 PCIe 3.0 slots, shielded onboard audio and that super-speedy M.2 x4 slot. The gaming performance of the ASRock board shows you're not really leaving anything in those PCIe slots either; you'll be squeezing near the maximum GPU juice out of your graphics cards. And the PCIe storage implementation is one of the quickest we've seen too. Both the ASRock boards in this test post the highest sequential read/write speeds we've seen, even if they're a little more shy over their 4K random writes.

CLOCKING ON

Where the X99M Extreme4 impresses even more is in overclocking prowess. This is one of the cheapest X99 boards we've tested in this issue or any other, and yet it's still rocking a full 12-phase power design. That enabled us to get all the way up to 4.4GHz, and we can assume that's the maximum our 5960X engineering sample is capable of without some LN_2 sniffing.

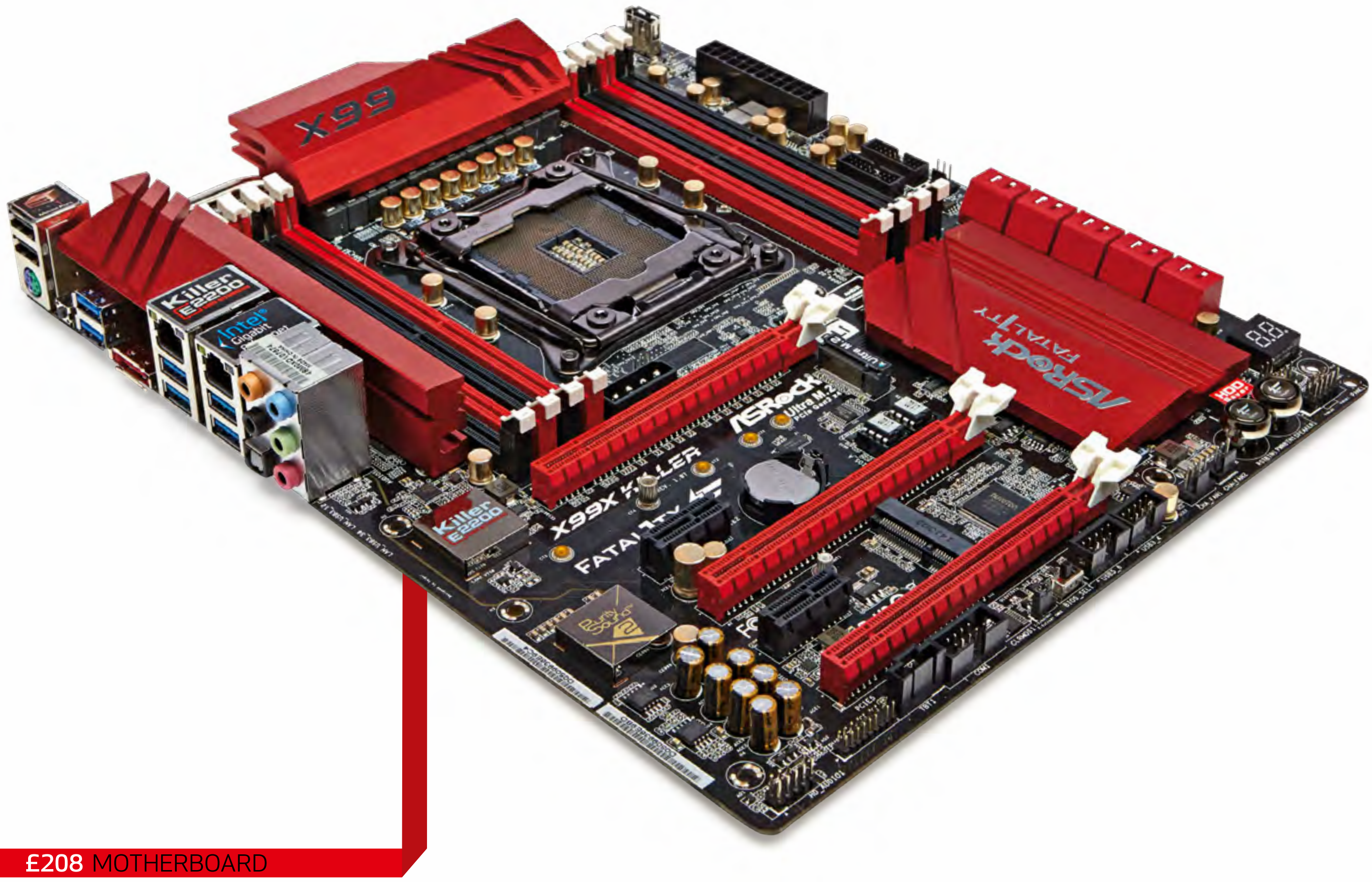
Memory performance is the only place we're not so impressed with the Extreme4. Standard 2,133MHz performance is up there with the best, but the XMP of our high-end Corsair 2,800MHz RAM did nothing good for our board – we couldn't even get it to boot. If you're going for a low-price X99 to match your 5820K though, you'll likely be happy with 2,133MHz memory and when we're talking in those terms, this ASRock board is possibly our favourite budget X99 of them all. ■

PCFormat Verdict

Features	★★★★☆
Performance	★★★★½
Value	★★★★★

A great-value X99 board that boasts fantastic performance metrics in spite of its miniature stature and price tag.

★★★★½



£208 MOTHERBOARD

ASROCK FATAL1TY X99X KILLER

VITAL STATISTICS

Price £208
Manufacturer ASRock
Web www.asrock.com
Form factor ATX
Graphics 3x PCIe 3.0 x16
Multi-GPU support Up to 3-way AMD CrossFireX/Nvidia SLI
Memory 8x DDR4 DIMMs
Storage 10x SATA 6Gbps, 1x eSATA, 1x M.2 x4
Back panel 6x USB 3.0, 2x USB 2.0, eSATA, PS/2 combo, 1x Intel LAN, 1x Killer E2200 LAN, Audio I/O

There really isn't much to separate the pair of ASRock boards kicking off this X99 motherboard test. There are some obvious differences in scale and memory support, but in the rest of the spec – and particularly performance – these two mobos are like peas in a PCB pod.

There's a pretty good reason for that – they're both from essentially the same family. True, this ATX version is from the higher-end Fatal1ty Killer series, with gleaming metallic red heatsinks following the Wendel-based branding, but if you peel the name sticker off the X99M you'll find it's a Fatal1ty PCB too. ASRock has used the same actual board for both the micro ATX Extreme4 and Fatal1ty X99 mobos, then swapped the red heatsinks for blue and added a Killer networking chip. It works the other way around too – underneath the X99X Killer sticker, the Extreme6 branding is printed on the PCB.

That all speaks well to the build of ASRock's boards, because this full-scale Fatal1ty version is a real powerhouse. The premium components used in its makeup make the X99X one of the quickest overall boards in our test, only slipping behind the excellent Asus X99 Deluxe in stock performance benchmarks. It also has the same speedy storage as its smaller sibling, allowing for the same quick sequential read/write speeds from the PCIe M.2 connection.

The weighty power design used in both ATX and mATX form factors means the overclocking performance of the Fatal1ty board is almost identical to that of the X99M Extreme4. We hit 4.4GHz easily, partly thanks to the quality of the board itself and also to the impressive new ASRock BIOS screens. The company has obviously been putting the work in on that front, making tweaking your machine a doddle. Like the MSI board, the ASRock BIOS has a neat Multicore Enhancement option that lets you bypass the 3.3GHz limit Intel has in place to stop the 5960X hitting its 3.5GHz Turbo speed when all cores are in use. Switch it on and you'll run up to 3.5GHz without any trouble, pushing up your CPU performance with no overclocking hassle.

RENDERED USELESS

But because the ASRock boards are so similar, it's no surprise that the Fatal1ty board shares the XMP restrictions on our high-end Corsair RAM. We did get a little further with this larger board though – there's an option to overclock to 4GHz in association with XMP which allowed us to boot. Once. The memory was running at 1.35v rather than 1.2v and the whole machine crashed in the second runthrough of the Cinebench rendering test.

This wasn't such a problem for the cheaper micro ATX board, but this £200+ option really ought to be capable of running at the 3,000MHz overclocked memory setting on the box. This is the whole reason XMP was created – so we don't have to mess around with timings and voltages to get our RAM to run. And when Asus' OC Socket is capable of running the top memory settings without breaking a sweat, for the same price, the X99-A suddenly becomes a far more attractive board. ■

PCFormat Verdict

Features	★★★★½
Performance	★★★★☆
Value	★★★★☆

A solid, weighty motherboard, with impressive performance only let down by its disappointing memory support.

★★★★☆

DIGI+ VRM
DIGI+ DRAM
ASUS
X99-A
5-Way Optimization
CRYSTAL SOUND 2

£203 MOTHERBOARD

ASUS X99-A

VITAL STATISTICS

Price £203
Manufacturer Asus
Web www.asus.com
Form factor ATX
Graphics 3x PCIe 3.0 x16, 1x PCIe 2.0 x16 (max x4 speed)
Multi-GPU support Up to 4-way AMD CrossFireX/Nvidia SLI
Memory 8x DDR4 DIMMs
Storage 8x SATA 6Gbps, 1x SATA Express (including two extra SATA 6Gbps ports), 1x M.2 x4
Back panel 6x USB 3.0, 4x USB 2.0, 1x PS/2 combo, Intel LAN, BIOS reset switch, Audio I/O

The nigh-on £300 Deluxe motherboard (see right) is probably beyond the financial reach of most of us when building a PC, but thankfully Asus isn't confining its X99 efforts to the very highest end of the market. The £200 X99-A may still be relatively costly, but when we're talking about this almost server-class X99 platform £200 should probably be considered the mid-range price point.

And the X99-A will happily slot in between its super high-end Deluxe stablemate and the cheaper end of the market where the MSI and ASRock boards rule the roost. It has everything that makes the X99 platform such a high-end one – full eight DIMM slot DDR4 support, SATA Express and M.2 PCIe storage connections, multiple x16 PCIe 3.0 slots for multi-GPU builds and proper overclocking support. There's a host of other checks in the feature list too, including an EM-shielded onboard soundcard, physical switches for EZ XMP settings, and power efficiency features.

It even shares the classy stormtrooper white and black finish of its Deluxe sibling. So, while you *can* call this a mid-range X99 board, you'll have your 'value for money' boxes well and truly ticked by the bulging Asus feature set.

It also has the metrics nailed down in terms of stock CPU performance, keeping pace with the big boys of the X99 world. Asus is using the same bespoke OC Socket in its whole X99 range instead of the standard Intel LGA 2011-v3 socket. This adds extra pins to the layout, meaning it touches connections on the Haswell-E chips the standard socket doesn't. Asus' engineers claim this helps provide stable voltages for overclocking, specifically to help with memory performance. In that it rings true as the two Asus boards were the only ones able to cope with Corsair's 3,000MHz XMP settings and the X99-A posted the highest overclocked Cinebench score behind the X99 Deluxe.

GAME OVER

Unfortunately, when it comes to storage performance and gaming speeds, the positivity ends. Overall the PCIe storage performance from the M.2 x4 slot was the weakest of the seven boards we tested, with both random and sequential write performance lagging behind the rest.

The gaming performance lapse is the biggest surprise, however. Asus has long been at the forefront of gaming components and, even if only by a few fps, its motherboards generally held the top spots in any in-game benchmarks. Over the last couple of years though Gigabyte has pushed past Asus to take the performance lead. Gigabyte takes top gaming honours for this latest Intel platform too, but now Asus isn't just slipping back to second place; it's at the bottom of the benchmark list.

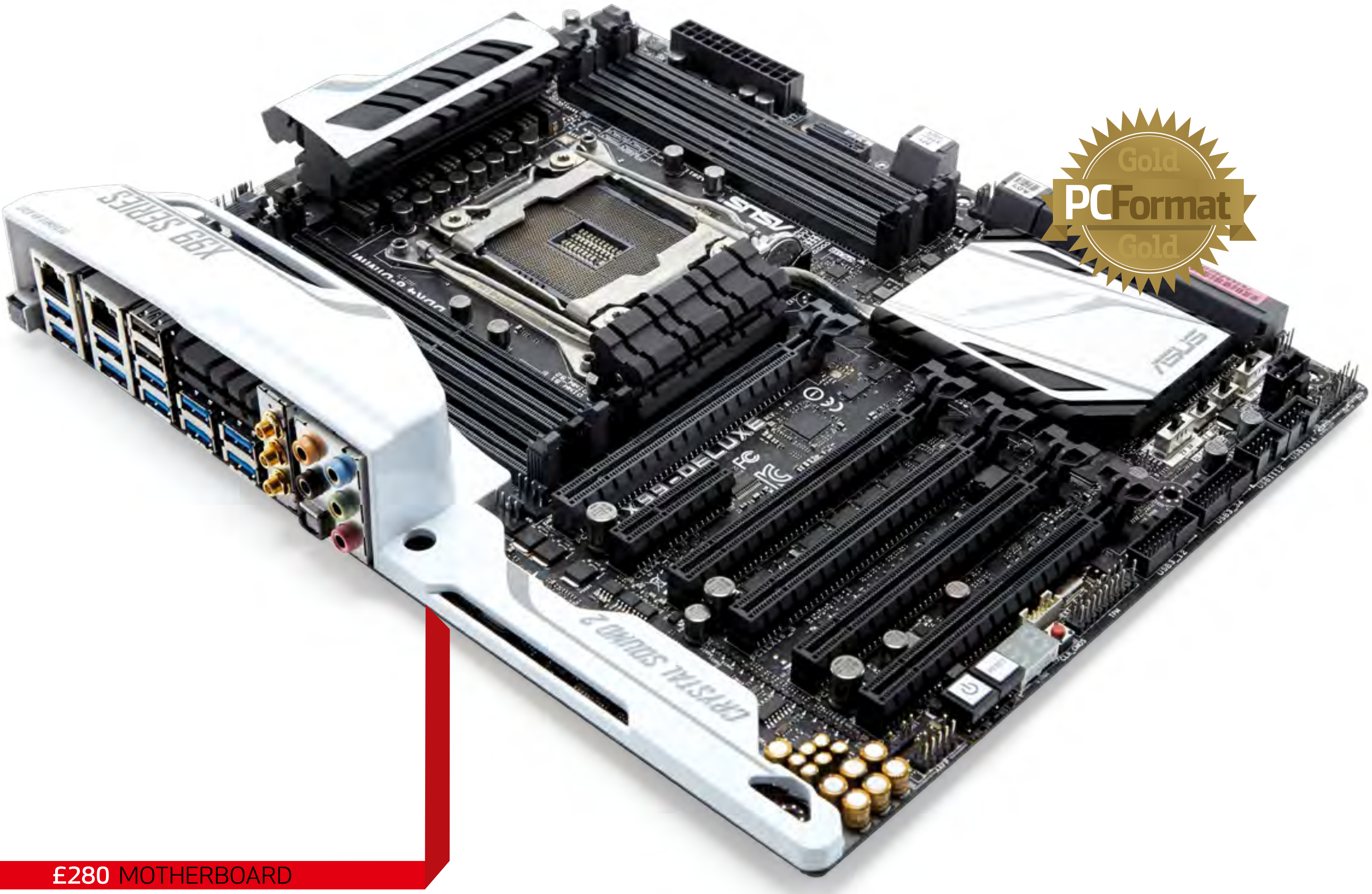
Asus's mid-range X99-A is a good value board for an all-round performance PC, especially if you're looking at getting the most out of your memory and overclocked CPU. But you're a dedicated gamer trying to squeeze as much performance as you can out of a multi-GPU array, maybe Asus is no longer the go-to choice. ■

PCFormat Verdict

Features	★★★★½
Performance	★★★★☆
Value	★★★★☆

A quality mid-range X99 board with a hefty feature set, but slightly lagging in gaming and PCIe storage performance.

★★★★☆



£280 MOTHERBOARD

ASUS X99 DELUXE

VITAL STATISTICS

Price £280
Manufacturer Asus
Web www.asus.com
Form factor ATX
Graphics 5x PCIe 3.0 x16
Multi-GPU support Up to 4-way AMD CrossFireX/Nvidia SLI
Memory 8x DDR4 DIMMs
Storage 8x SATA 6Gbps, 1x M.2 x4, 2x SATA Express (including four extra SATA 6Gbps ports)
Back panel 10x USB 3.0, 2x USB 2.0, 2x Intel LAN, Wi-Fi, Audio I/O, BIOS reset

We've hit the X99 motherboard motherlode. You won't find a more feature-packed slice of circuit board this side of Johnny Five. In a world where the mobo has less and less import thanks to so much logic being integrated into the CPU package, we've seen many sparse boards recently, with a wasteland between their PCIe slots and dead air around the socket. That's certainly not the case with Asus' top of the line X99 offering, the X99 Deluxe.

It's packed from corner to corner with components, expansion slots and features, all in the most pleasing design Asus has ever dropped onto its consumer range of boards. Gone are the faded blue of the X79 and the gold of the Z97s; now it's all stormtrooper white with black lowlights.

AND THE KITCHEN SINK

We could give a full rundown of this board's entire feature set, but we'd overrun this page considerably if we did. Suffice to say that if there's a high-end feature that stands out for the X99 platform then the Asus has it. And probably two of them. From the packed-out back panel to the vast array of storage options, the Deluxe is more than just a clever name.

This is the board you'll use to power a computing behemoth, though it's a more generalised mobo than something like the Gigabyte X99-SOC Force or even the crazy-expensive RoG Rampage V Extreme. Those are more keyed to extreme overclocking – they're boards designed to sit on a test bench drowning in liquid nitrogen. The X99 Deluxe is more of an all-round performer, offering the sort of connectivity you'd expect of a mini server board, which is essentially where it's come from. The serious memory performance, twin SATA Express ports and lack of extraneous features like voltage checkpoints are testament to that. Which isn't to say this isn't still a seriously quick, powerful board, up there with the performance metrics those more extreme X99s are capable of.

The Deluxe is still using the same OC Socket Asus has packed its X99 range with, so this is the only other board in the test capable of offering overclocking support up to the 3,000MHz our Corsair memory kit is rated at. It's also the most capable standard overclocker of the bunch – not necessarily in the overall CPU clockspeed, but in the actual benchmarked performance at its maximum overclock. We must stress though that's only in terms of the rather basic, liquid-cooled overclocking us norms are capable of, not the LN2-sniffing that something like Gigabyte's impressive X99-SOC Force caters to.

The only disappointment with the Deluxe is, like its Asus stablemate, in the gaming performance. The fact that the Asus boards are around the bottom, albeit in only a single benchmark, is a surprise. Even the likes of ASRock now post higher average frame rates.

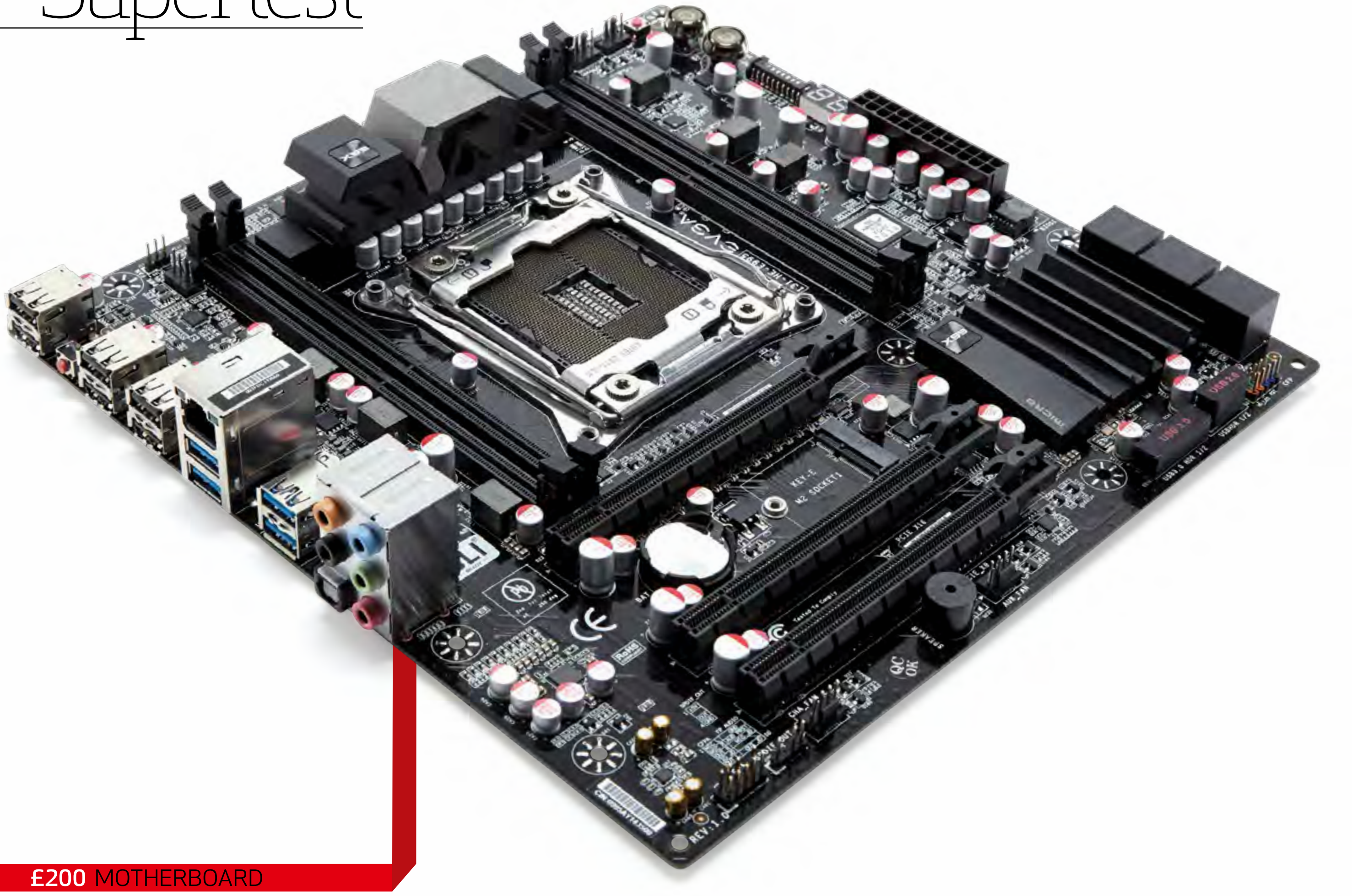
But that's a rather intangible smudge on its report card; the Deluxe is the board we'd want as the basis of any X99 computing workhorse. It's one of the most expensive in the test, but the connectivity, feature set and overall performance you get go a long way to making it worth it. ■

PCFormat Verdict

Features	★★★★★
Performance	★★★★★
Value	★★★⯪☆

A great quality, high-performance board, with a feature-list longer than Mr Tickle's favourite appendages.

★★★★⯪



£200 MOTHERBOARD

EVGA X99 MICRO

VITAL STATISTICS

Price £200
Manufacturer EVGA
Web www.evga.com
Form factor Micro ATX
Graphics 3x PCIe 3.0 x16
(third slot x8 only)
Multi-GPU support Up to 3-way
AMD CrossFireX/Nvidia SLI
Memory 4x DDR4 DIMMs
Storage 6x SATA 6Gbps
Back panel 4x USB 3.0, 6x USB 2.0,
Intel LAN, Clear CMOS button,
Audio I/O

We were a little excited when we got EVGA's mini X99 Micro into the labs last month. It was the first small form factor X99 board we'd come across, and the potential to have a little performance powerhouse was a tantalising prospect. And so we were more than willing to cut it a little slack given the trimmed-down PCB it was working with.

Unfortunately, somewhere along the postal chain, a thumb had been unceremoniously jammed into the socket, rendering it more than a little forgetful. Check out the socket in last month's centrefold to see exactly where chewed-up pins will break down a few memory channel connections…

Pushing the performance review back to this month has meant that it goes head-to-head with ASRock's own micro ATX X99M Extreme4, and the comparison is not a kind one for the wee EVGA board. The mATX ASRock is more feature-complete for an X99 mobo than this X99 Micro, for the simple fact that it's running the full x4 M.2 socket while this EVGA board only has a mini PCIe connection for Wi-Fi modules, not storage.

But PCIe storage is a very immature market, and we'd bet few M.2 slots are being filled when it comes to fully built X99 PCs. So, in the grand scheme of things, that's not really a huge miss for the X99 Micro. The struggle is that it's also a little behind the performance of its ASRock competition. The stock CPU and gaming performance is pretty close, but the damning thing for this sort of computing platform is the memory capabilities on the X99 Micro are so limited. It posts the weakest DDR4 performance of the entire grouptest and, where most of the other tests are at least relatively close across the group, the EVGA board is a long way behind in memory prowess. It's almost 3GB/s slower than the ASRock.

SMALL FRY

Thanks to the fact the ASRock board is winning the numbers game against the X99 Micro, with a 12-phase power design against the EVGA's six-phase setup, this board is also lagging a little behind in terms of overclocking performance too. Like the full ATX ASRock, we were able to get it to briefly run with the Corsair XMP in place for 2,800MHz, but it was incredibly flaky the one time we did get into the OS and we were never able to get it to boot at that speed again.

You might look at the benchmark numbers on the following pages and think we're being a little harsh on the X99 Micro, considering it's all very tight apart from the memory metrics. But there is one other place where it lags behind its only other mATX competition, and that's price.

The ASRock represents great value, being one of the most affordable X99 boards we've tested, but at £200 the X99 Micro feels like a lot of money when you're missing some of the functionality and performance of similarly priced or less expensive motherboards. We do like the form factor EVGA has squeezed its X99 board down to, but it's beaten on all the price, performance and feature set fronts. ■

PCFormat Verdict

Features ★★★½☆
Performance ★★★★☆
Value ★★★☆☆

EVGA was a little quick to the mATX X99 market with this board, which has fallen behind the competition on all counts.

★★★½☆

£300 MOTHERBOARD

GIGABYTE X99-SOC FORCE

VITAL STATISTICS

Price £300
Manufacturer Gigabyte
Web http://uk.gigabyte.com
Form factor Extended ATX
Graphics 2x PCIe 3.0 x16, 2x PCIe 3.0 x16 (running at x8 speeds)
Multi-GPU support Up to 4-way AMD CrossFireX/Nvidia SLI
Memory 8x DDR4 DIMMs
Storage 8x SATA 6Gbps, 1x SATA Express (including two extra SATA 6Gbps), 1x M.2 x4
Back panel 8x USB 3.0, 4x USB 2.0, CPU overclocking button, BIOS switch button, Clear CMOS button, PS/2 combo port, Intel LAN, Audio I/O

Gigabyte's X99-SOC Force reminds us of standing in a small room at the top of the skyscraping Taipei 101 building, the floor awash with liquid nitrogen. When there are overclocking records at stake, no amount of health and safety fluff is going to get in the way of a dedicated LN$_2$-sniffer sloshing steaming flasks full of the stuff.

You can practically smell the faint vanilla odour of coolant the instant you pull the SOC Force out of its packaging. This is a board that's simply begging to be sat on an open test bench and tortured with super high voltages and super-low temperatures.

And that, therefore, means this motherboard is not necessarily one for the vast majority of us – even those looking to put together a mean X99 machine. That's nothing to do with the feature-set – this high-priced board still includes all the important X99 features despite its OC obsession. The issue is that it's not tuned for stock CPU performance. The SOC Force isn't designed to toddle along at conservative settings, and so doesn't impress in performance terms straight out of the box.

Straight CPU performance is pretty mediocre, as is the DDR4 memory performance. PCIe storage performance is rather lackluster too, offering the lowest 4K performance of all the boards capable of being tested with our Plextor M.2 SSD. The gaming performance is pretty good though, again demonstrating Gigabyte's dominance when it comes to motherboard gaming support at the moment.

Even when it comes to our basic overclocking tests, the SOC Force doesn't really set the world alight. It did get the joint highest overclock in the test, but was short of the X99 Deluxe in actual overclocked benchmark performance. But such pocket calculator stuff is not where the SOC Force wants to be – the enclosed GPU bracket, designed to support multiple graphics cards on an open test bench, and plethora of buttons and switches on the motherboard itself speak to this.

SERIOUS BUSINESS

Gigabyte clearly wants this to be the pro-OC board of choice. There's a host of features designed specifically to allow you to get into your OS at the lowest CPU settings and quickly throw the voltages and frequencies through the roof to hit your OC records. There are even physical buttons to allow you to shift the ratio up and down and push the baseclock around in either 0.1MHz or 1MHz increments. The fine-grain physical controls are very impressive, and if you're looking to get your handle onto HWBot then the £300 cost of the SOC Force is unlikely to deter you.

But this isn't a board for someone who *isn't* going to be filling their garage with LN$_2$ canisters. If you're only going to be messing with CPU ratios and maybe a little light voltage tweaking to get your Haswell-E chip running quicker then this isn't worth the premium. That said, we still can't help but love the no-nonsense approach Gigabyte has taken with its straightforward function-over-style layout. ■

PCFormat Verdict

Features	★★★★★
Performance	★★★★☆
Value	★★★½☆

This is a serious motherboard for serious overclockers, but everyone else should probably spend their money elsewhere.

★★★★☆

msi
X99S SLI PLUS
msi

£160 MOTHERBOARD

MSI X99 SLI PLUS

VITAL STATISTICS

Price £160
Manufacturer MSI
Web www.msi.com
Form factor ATX
Graphics 4x PCIe 3.0 x16
Multi-GPU support Up to 3-way AMD CrossFireX/Nvidia SLI
Memory 8x DDR4 DIMMs
Storage 8x SATA 6Gbps, 1x SATA Express (including two extra SATA 6Gbps), 1x M.2 x4
Back panel 8x USB 3.0, 2x USB 2.0, 1x PS/2 port, Intel LAN, Clear CMOS, Audio I/O

And we've saved the cheapest for last. Actually, that sounds rather disrespectful to a board that we're rather fond of, and not just because it costs almost half the price of the previous Gigabyte mobo. MSI has done a sterling job with this board, creating at once an X99 option that doesn't command the huge price premium we've come to expect from this top chipset, but neither does it skimp on the features it offers.

There are no super-sexy, glossy heatsinks adorning the power components. There's no fancy lighting, either – just a very functional basis for a great value, high-end platform. Pair this up with the cheaper end of the Haswell-E silicon, the Core i7-5820K, and you'll have a high-performance setup that's not too far behind the pace set by the top X99 components, yet costs around a third of the price.

And by 'functional', we mean all the goodness the X99 platform can offer. From a full eight slots of quad channel DDR4 memory, to both top-end PCIe-based storage connections, to three-way multi-GPU support in both Nvidia and AMD flavours, MSI's bargain SLI Plus has the necessary goods.

GREAT VALUE

As you might expect from the cheapest of the X99 boards we've tested, the SLI Plus isn't going to win any performance awards, but that doesn't mean its seriously lagging behind the rest. It's competitive with even the high-spec Gigabyte and Asus boards, always in and amongst the pack. In fact it actually posts higher stock-clocked CPU performance numbers than the Gigabyte board at almost twice the price. It's also able to post pretty decent PCIe storage benchmark results too, coming second in terms of the 4k random performance.

Where it didn't perform so well (bottom of the class, in fact) was in the overclocking stakes. Even with a dedicated eight-phase power design it struggled at 4.3GHz with our Core i7-5960X, posting a lower Cinebench score than the X99 Micro from EVGA. While that would normally be a negative, we're happy to overlook it when the overall cost of the board is so much lower than most of the others on test.

Were it not for the seriously impressive performance of the ASRock X99M Extreme4, MSI's SLI Plus would hands-down get the nod as the budget hero of this test. As it is though ,we're a bit torn over which one we'd recommend for a 5820K-based budget build. The mATX board might be missing a set of four DDR4 DIMM slots, and realistically isn't going to be capable of a full three-way GPU setup, but in the budget end of the market you're unlikely to fill all those slots anyway.

What might just sway you towards the MSI board could be the gaming performance. The average frame rate is a little behind the rest, but the minimum frame rates are the highest, by quite a long way. That would indicate you're likely to get smoother gaming performance, even if it's a couple of fps lower on average. When the margins are so fine, that sort of benefit could make a real difference to your buying decision. ■

PCFormat Verdict

Features	★★★★⯪
Performance	★★★★☆
Value	★★★★★

A great value X99 motherboard that shows you don't need to spend a fortune to get the Haswell E performance.

★★★★⯪

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NEW: WORDPRESS
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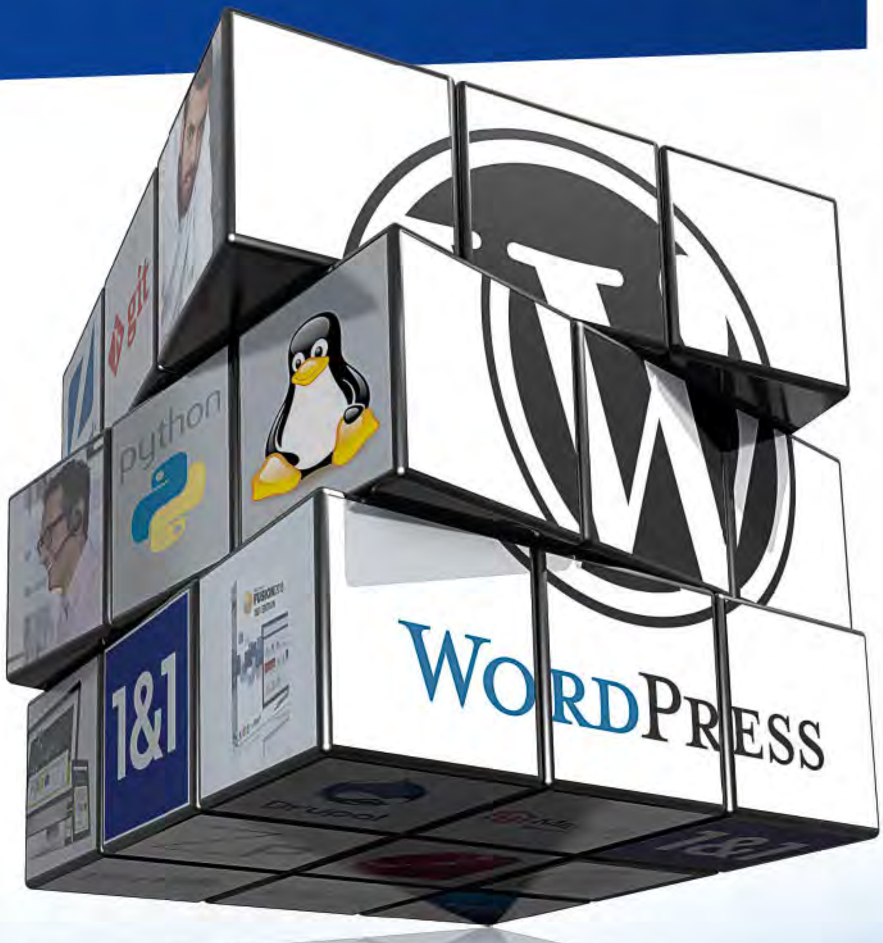

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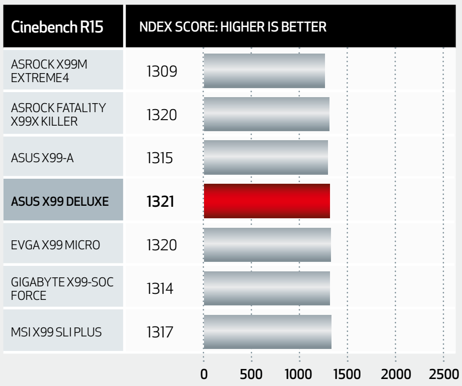
How we tested

It's all about the numbers with motherboards. Well, when it comes to actual testing anyway. The overall feature set and compatibility features are what will bring a particular set of boards to your attention, but it's how those individual motherboards actually perform when you get your mitts on them that matters in the final reckoning.

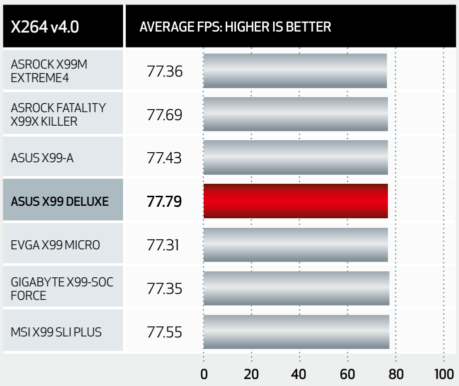
To try and cover all the bases, we ran a full suite of benchmarking and diagnostics on each of the boards we have tested this month. Of primary importance is how well each board supports the processor it's housing. We also tested next-gen memory and PCIe storage performance, as well as gaming speeds and energy efficiency.

With a high-performance chipset we want to know if each board will allow for any level of overclocked performance too. We aren't pro-overclockers here, so we only want to recreate the simple OC levels the majority of us can do at home ourselves. ■

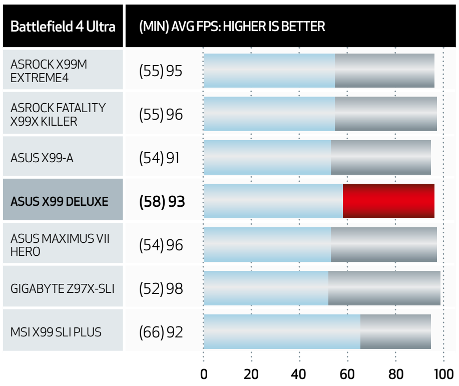
Multicore CPU rendering performance



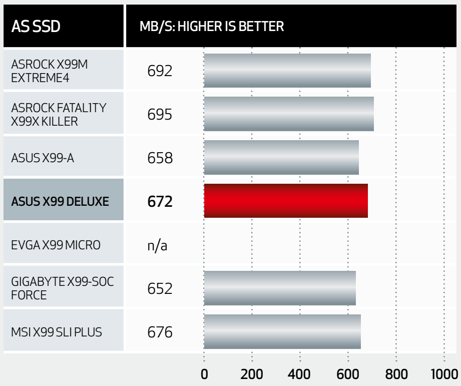
CPU HD encoding performance



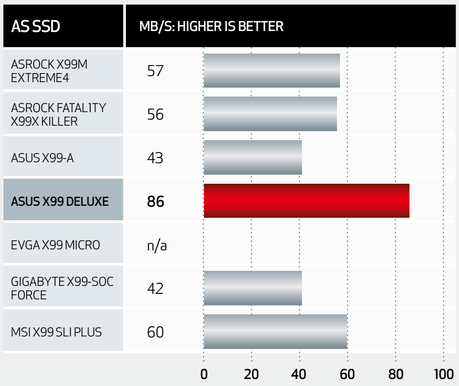
Gaming performance (1080p)



PCIe storage sequential read performance

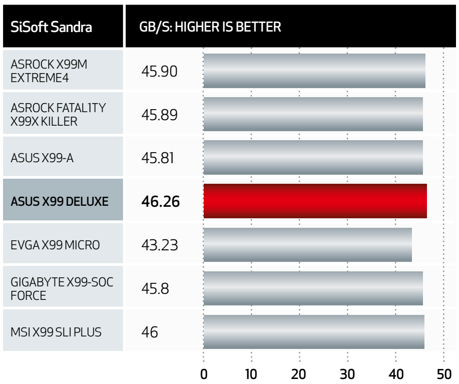


PCIe storage random write performance

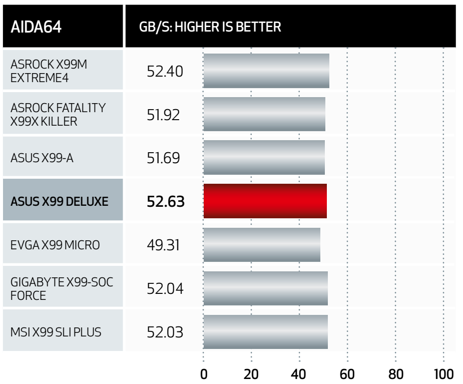


	Price	Web	Manufacturer	Form factor	CPU Socket	Graphics
ASRock X99M Extreme4	£170	www.asrock.com	Asrock	Micro ATX	Intel LGA2011-v3	2x PCIe 3.0 x16, 1x PCIe 2.0 x16
ASRock Fatal1ty X99X Killer	£208	www.asrock.com	Asrock	ATX	Intel LGA2011-v3	3x PCIe 3.0 x16
Asus X99-A	£203	www.asus.com	Asus	ATX	Asus OC Socket	3x PCIe 3.0 x16, 1x PCIe 2.0 x16 (x4 speed)
Asus X99 Deluxe	**£280**	**www.asus.com**	**Asus**	**ATX**	**Asus OC Socket**	**5x PCIe 3.0 x16**
EVGA X99 Micro	£200	www.msi.com	EVGA	Micro ATX	Intel LGA2011-v3	3x PCIe 3.0 x16 (third slot x8 only)
Gigabyte X99-SOC Force	£300	http://uk.gigabyte.com	Gigabyte	Extended ATX	Intel LGA2011-v3	2x PCIe 3.0 x16, 2x PCIe 3.0 x16 (running at x8)
MSI X99S SLI Plus	£160	http://uk.msi.com	MSI	ATX	Intel LGA2011-v3	4x PCIe 3.0 x16

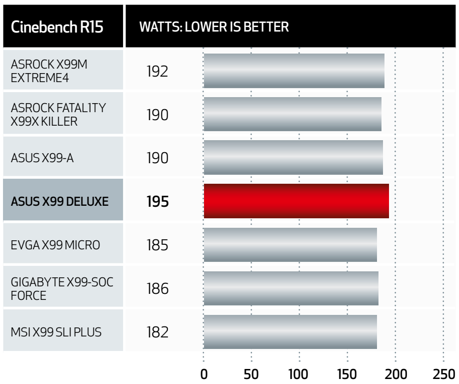
Memory bandwidth performance



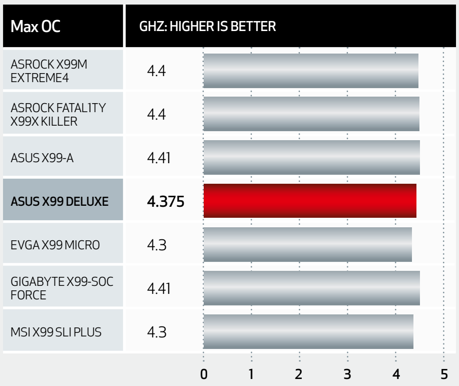
Memory copy performance



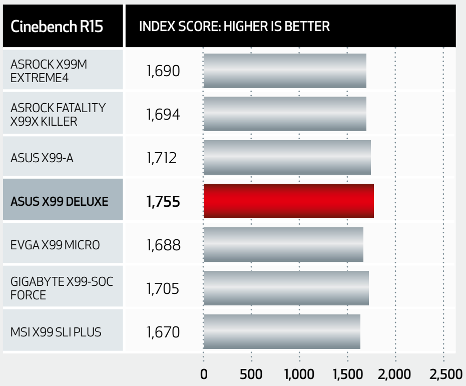
Peak power draw



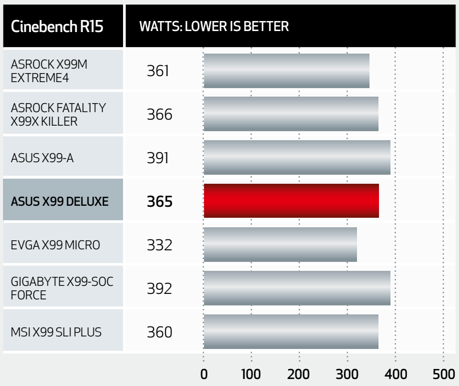
Overclocking performance



Overclocking performance



Overclocking power draw



	Storage	Multi-GPU	Back Panel	Score
	10x SATA 6Gbps, 1x eSATA, 1x M.2 x4	Quad AMD CrossFireX/Nvidia SLI (only with dual-GPU cards)	4x USB 3.0, 4x USB 2.0, PS/2 combo, eSATA, 1x Intel LAN, 1x Atheros LAN, Audio I/O	★★★★½
	10x SATA 6Gbps, 1x eSATA, 1x M.2 x4	Up to 3-way AMD CrossFireX/ Nvidia SLI	6x USB 3.0, 2x USB 2.0, eSATA, PS/2 combo, 1x Intel LAN, 1x Killer E2200 LAN, Audio I/O	★★★★
	8x SATA 6Gbps, 1x SATA Express (inc. 2x SATA 6Gbps), 1x M.2 x4	Up to 4-way AMD CrossFireX/ Nvidia SLI	6x USB 3.0, 4x USB 2.0, 1x PS/2 combo, Intel LAN, BIOS reset switch, Audio I/O	★★★★
	8x SATA 6Gbps, 2x SATA Express (inc. 4x SATA 6Gbps), 1xM.2 x4	**Up to 4-way AMD CrossFireX/ Nvidia SLI**	**10x USB 3.0, 2x USB 2.0, 2x Intel LAN, Wi-Fi, Audio I/O, BIOS reset**	★★★★½
	6x SATA 6Gbps	Up to 3-way AMD CrossFireX/ Nvidia SLI	4x USB 3.0, 6x USB 2.0, Intel LAN, Clear CMOS button, Audio I/O	★★★½
	8 x SATA 6Gbps, 1x SATA Express (inc. 2x SATA 6Gbps), 1x M.2 x4	Up to 4-way AMD CrossFireX/ Nvidia SLI	8x USB 3.0, 4x USB 2.0, CPU overclocking button, BIOS switch button, Clear CMOS button, PS/2 combo port, Intel LAN, Audio I/O	★★★★
	8x SATA 6Gbps, 1x SATA Express (inc. 2x SATA 6Gbps), 1x M.2 x4	Up to 3-way AMD CrossFireX/ Nvidia SLI	8x USB 3.0, 2x USB 2.0, 1x PS/2 port, Intel LAN, Clear CMOS, Audio I/O	★★★★½

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X99 SERIES
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AND THE WINNER IS…

ASUS X99 DELUXE

The tough thing about the X99 platform is that we're generally talking about creating incredibly high-performance machines out of the base components on offer. And that almost inevitably means we have to start talking about incredibly high prices too.

One of the most refreshing things about this latest Extreme chip/chipset combo from Intel is that there's actually a surprising amount of value surrounding X99. Of course, there are very expensive CPUs and motherboards, but there are also great-value combos that will deliver serious computational power over and above the standard Haswell range of consumer chips.

In this grouptest we've seen two of the finest budget X99 motherboards around, and neither is just a heavily cut-down version of the chipset either. The Micro ATX ASRock X99M Extreme4 and the MSI X99S SLI Plus are both excellent value boards with the performance and feature-set to allow them to stand among even the very priciest of the competing boards. Of the two, it's tough to say which we prefer – the small form factor is a nice touch, and it's the quicker of the two, but the MSI has much higher minimum frame rates in our gaming test. But either way, both boards will form a great basis for a Haswell-E PC.

It's a lot harder to distinguish between the mid-range of the X99 gang. The first we can discount is the X99 Micro from EVGA. Like the ASRock X99M Extreme4, it's another mATX board, but is a little more shy about its performance credentials and lacks the next-gen PCIe-based storage options offered by every single other X99 board we've tested.

It then becomes a battle between the ASRock and Asus boards for mid-range supremacy. Had it not been for something strange going on with the XMP support for our high-spec Corsair DDR4 we'd probably have gone for the Fatal1ty X99X Killer. Its gaming and storage performance are ahead of the similarly-priced X99-A, but the Asus board has a neat trick up its sleeve, which is the fact that it isn't using the same Intel LGA 2011-v3 socket as the other manufacturers.

Asus noticed there were more pins on the Haswell-E chips than there were in the ol' LGA 2011-v3 socket. Its engineers seem to think this has something to do with supplying a more stable level of power throughout the system, which should help with overclocking. Asus specifically states that its OC Socket boosts memory performance, and since only its boards have been able to hit the 3,000MHz our Corsair RAM is capable of, that seems to ring true. The two Asus boards topped the class in overclocked benchmark performance too.

> "THERE'S A SURPRISING AMOUNT OF VALUE SURROUNDING X99"

Gigabyte's X99-SOC Force does deserve a mention, even though it's not our favourite high-end motherboard. The single-minded pursuit of serious overclocking performance it demonstrates is fantastic. Our favourite then remains the Asus X99 Deluxe, it's got that OC Socket, making it the best overclocker in our test and has a feature list longer than a Google exec's skydive. ■

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Hardware #299/Christmas

Performance gear, uncompromising verdicts

WHAT ARE YOU DOING, DAVE?

"That silky smoothness really does leave you pining for it when you switch to lesser screen tech"

Dave James has spent most of the last month rocking gently back and forth in his chair as he struggles to cope with yet another *PC Format* office move. The simple lad doesn't deal well with change, but Alan made sure to butter up his paws before he was allowed out for the first time, and he's now slowly adjusting to his new surroundings.

To distract myself from the stress of an enforced change of scenery, I've been filling my mind and my eyes with the search for perfection. To be fair I've got a better view in our new office – looking out over the beautiful city of Bath rather than the backs of the *Linux Format* guys – but I've become obsessed this month with my ideas of the perfect hardware.

It's all stemmed from the latest MSI gaming laptop I've been using this issue and the gloriously widescreen monitor from AOC. And while I've been hugely impressed with both, I could describe neither of them as 'perfect'. Obviously they're both up against an entirely subjective view of perfection, and perhaps an entirely unachievable standard, but that's what we're all after: the ideal hardware for us.

In terms of gaming laptops, the MSI Stealth Pro comes mighty close given the tech available at the moment. It's got mighty fine gaming performance, is relatively slim, and is trundling along the path towards true mobile PC gaming. But, as ever, power storage is lagging way behind the performance of the rest of the machine. Nvidia's latest iteration of BatteryBoost does manage to extend your gaming time away from the mains, but only by a relatively small amount.

The AOC U3477Pqu widescreen monitor, I will admit, is a lot closer to my notion of perfection. It is higher res than the traditional 16:9 1440p panels and the 21:9 ratio gives a far more dramatic bent to any game you care to throw at it. Seriously, *Minesweeper* becomes an entirely different game. But, while that IPS panel *is* beautiful, it doesn't have the 144Hz refresh rate or G-Sync tech I've started to crave. I've been checking out high refresh rate screens in preparation for next month's issue, and that silky smoothness really does leave you pining for it when you switch to lesser screen tech…

But the new Philips BDM4065UC has neither the high refresh rate or G-Sync, and yet I really can't wait to get my eyeballs on that 40-inch 4K@60Hz marvel. It could be the screen that changes my mind about the relevance of 4K because the huge panel should negate the need for OS scaling, and with my face pressed up against it in-game it'll be like I'm actually there.

With the goalposts shifting again though, it still won't be perfect, and so the search will forever continue.

P24
MSI GS70 2QE STEALTH PRO

Philips' 40-inch 4K panel could deliver super resolutions without the need for the horrors of scaling

Gold Award

This is the ultimate badge of hardware excellence. Only truly outstanding gear gets this coveted award. Oh, and there are no prizes for runners-up here.

Our Hardware Manifesto

Would we buy it and should you buy it? That's all you want to know and it's all we care about. Performance and value for money are the two key pillars supporting the mighty *PC Format* Gold Award on its lofty pinnacle.

MSI's mechanical switch laptop

Looking for all the world like an early '80s electronic word processor (remember those?), pictures and specs have leaked regarding MSI's GT80 Titan laptop. This mighty beast is potentially the first notebook to hit the market with a full mechanical gaming keyboard, produced by the company's long-time collaborator SteelSeries, using clicky Cherry MX Brown switches. The laptop is apparently going to be packed with a pair of GTX 980M GPUs to really fill out its massive interior, and will weigh in at a seriously hefty 4.5kg. This is looking like one serious desktop replacement, but one that's also likely to buckle the legs of anyone actually resting it on their lap…

THERE BUT FOR THE GRACE OF CAMERON GO US…

Large-scale demonstrations have taken place across Hungary this month, as web users march against government proposals to impose a tax on internet usage. The largest have been in the capital, Budapest, where tens of thousands of people have taken to the streets demanding for the proposed levy on ISPs, set to begin next year, to be abandoned.

The plan is to tax the service providers up to a cap of 700 forints (just under £2) per individual subscriber, and up to 5,000 forints (around £13) per business user each month. The Hungarian government is claiming this will help it out with its current debt problems, but the opposition claims the new internet tax will actually damage the country's digital economy and leave it trailing even further behind the rest of the European Union.

The worry for us is if this catches on across Europe. The Hungarian government is at pains to point out that it's only taxing the ISPs, not the general public, but is being deliberately naive if it thinks those expenses wont get passed on to the consumers in some way.

EDITOR'S ONE TO WATCH

OneGet one's own package manager in Win10

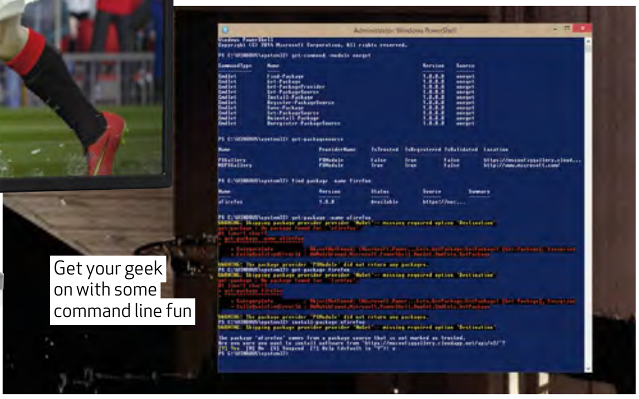
That grinding ivory noise you hear is thousands of Linux users gnashing their teeth as another purported 'year of Linux' comes to an inauspicious end. The hype surrounding the Steam Box and SteamOS has faded, presumably as Gabe has realised gamers just want to play their games in the easiest way possible, and Linux's compatibility woes means that's not the case with the open source OS.

Now we're starting to see the third-party Steam Boxes being sold by the companies that believed the hype and invested their money, but with Windows installed.

There was much gloating over the failure of Windows 8, with many Linux enthusiasts hoping that would push users towards the open source community. Microsoft though has been quick to respond, and is trying to wash away the taste of Win8 with a rapid new iteration of its OS. And to add insult to injured pride, Windows 10, is set to ape the most beloved of Linux features – the package manager.

The package manager, OneGet, was first rolled out with the Windows Management Framework 5.0 Preview for Windows 8.1, but has also been included in full in the current Windows Technical Preview build for Windows 10. It's only really accessible through the PowerShell, a more powerful version of the Command Prompt, and can be used to download, update and install applications with just a couple of lines.

Linux users will know what Microsoft is trying to do with OneGet, but if you're not a Windows system admin you might not know why it could be a big deal. It's not just a question of installing individual apps; you can also specify multiple packages to install at once. Imagine selecting all your standard/favourite apps to install on a fresh PC with a single command and leaving it to source and install it all. And you get to pretend you're a Hollywood hacker too, bashing merrily away at your keyboard…



Get your geek on with some command line fun

HIGHLIGHTS THIS MONTH

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28 Intel Core i7-5820K

INTEL® CORE™ i7-5820K
SR20S 3.30GHZ
COSTA RICA
3429A709
2W423006A0371
R3

33 AOC U3477Pqu

Alienware Graphics Amplifier

Desktop graphics joy for your Alienware lappy

After seeing MSI's GS30 and its chunky GPU dock at this year's Intel Developer Forum, it's good to see that it wont be the only notebook manufacturer to take up the external laptop graphics challenge again. Alienware is launching its Graphics Amplifier to go along with the Alienware 13 notebook, providing desktop GPU performance via a direct PCIe interface. At £200 for the basic box without an actual graphics card included, that's a pretty penny considering the Alienware 13 itself starts at just shy of a grand. But it means that you'll have a GTX 860M looking after your mobile gaming when you're on the road (for a total of around 40 minutes…) and then a full desktop experience when you plug in at home. It's a potentially intriguing setup.

£1,730 GAMING LAPTOP

MSI GS70 2QE STEALTH PRO

Anything this red simply can't be stealthy, but it can be seriously quick

VITAL STATISTICS

Price £1,730
Manufacturer MSI
Web http://uk.msi.com
SKU GS70 2QE-031UK-RED
CPU Intel Core i7 4710HQ @ 2.5GHz
GPU Nvidia GTX 970M
Memory 16GB DDR3L @ 1,600MHz
Storage 2x 256GB M.2 SSD, 1TB HDD
Screen size 17.3-inch
Native resolution 1,920 x 1,080
OS Windows 8.1

Unfair though it might seem to the Texans, if you want to buy a gaming laptop right now you're going to spend your cash on a machine with an Intel processor and an Nvidia graphics card. Look through most retailers' stock and you'll see an overwhelming percentage of notebooks rocking that familiar duopoly. AMD's lack of GPU efficiency is really telling in the mobile market.

And that means when Nvidia releases a brand new graphics processor, the world's laptop manufacturers sit up and take notice. We saw the first spins of its new GM204 GPU last month with the GTX 980 and GTX 970 desktop cards, and now we're seeing that chip finding its way into the latest gaming notebooks. This slimline MSI GS70 is rocking the GTX 970M version of the new Maxwell architecture and there's a lot to like about it. Except maybe for that extreme red paintjob.

Relative performance is always an issue, though. It's been a long time since we've had a notebook GPU that was simply an unplugged version of the desktop card; more recently the equivalent top mobile and top desktop GPUs have been almost entirely different beasts. Getting desktop performance out of your laptop is a costly affair though, putting considerable demands on both the battery and your wallet.

This time around, Nvidia is promising to close the gap between the desktop and notebook versions of its GPUs. Where Fermi had some 40 per cent the power of its desktop compatriots, and Kepler had 60 per cent at best, Maxwell is being touted as somewhere around 75 per cent the speed. So how close has it really managed to get, and how did it get there?

Max Headroom

Last month we went into a considerable amount of detail about what the desktop Maxwell GPU architecture offers compared to the Kepler design, and much of that goodness has translated down to the mobile version too. The GM204 GPU in the desktop cards and the one in the notebook versions are largely the same, but inevitably both the CUDA core count and the clockspeed have been cut for the mobile edition.

And those cuts seem to be pretty substantial. The GTX 970M that we're testing in this MSI GS70 only contains 1,280 CUDA cores. Compared with the 1,664 cores of the desktop card, that's a 23 per cent reduction in the basic building blocks of the GM204 GPU. And when it comes to the texture units and ROPs, you're looking at similar percentage drops across the entire core configuration.

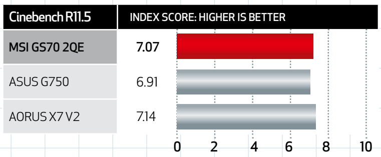
But when Nvidia is claiming only a 25 per cent reduction in performance on the surface, that seems to represent a pretty linear scale. The clockspeed has only dropped by about half that, though; the baseclock of the GTX 970M is a steady 924MHz, whereas the desktop version is sitting pretty at 1,050MHz.

Looking back at the specifications for the last generation, the Kepler-based GTX 870M does make the latest mobile Maxwell look a

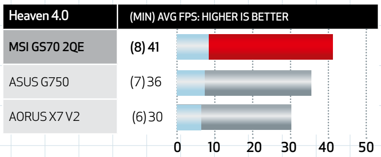
Technical analysis

MSI's impressive GS70 is easily the quickest laptop we've tested so far, and it's all down to the Maxwell-powered GTX 970M inside. The gaming performance is well in advance of the top Nvidia GPU of the last generation, and is able to offer improved battery life thanks to GFE too.

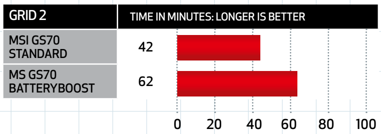
CPU rendering performance



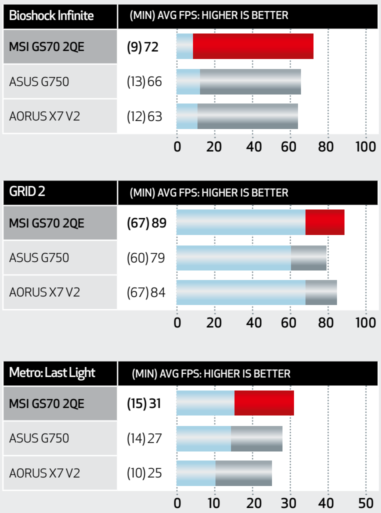
DirectX 11 synthetic performance



Battery life



DirectX 11 gaming performance



little off the pace. The GTX 870M had a full 1,344 CUDA cores and 32 more texture units as well, and it's clocked slightly faster. The new Maxwell architecture has allowed for this apparent deficiency though. From the Fermi generation, Nvidia has been organising its cores into streaming microprocessors (SM units), normally housing 192 cores in each. With Maxwell that number has dropped to 128, but this means it can squeeze more SM units into each spin of the GM204.

There are 10 SMs in the Maxwell chip compared with just seven in the Kepler. Nvidia estimates the increased parallelism the extra SMs offer allows each core to deliver 35 per cent more performance than the last generation cores. Sadly there wasn't a mobile Kepler GPU with 1,728 cores for us to see if the 1,280 Maxwell cores could keep up. But the old GTX 880M housed 1,536 of 'em and is evidently short of the GTX 970M's gaming performance.

Per core performance isn't necessarily the most important metric for a gaming laptop, though. The fact that the Maxwell architecture is so much more efficient than Nvidia's previous GPU generations should be a big deal when we're trying to free the gaming laptop from the plug socket. That's one of the ideas about these latest GPUs that Nvidia really wants to push – the idea of gaming away from the power supply.

BatteryBoost

Nvidia's BatteryBoost technology isn't new – it was first introduced with the GTX 800M class notebooks as a way to extend the gaming life of your laptop's battery. The Maxwell implementation is a lot more intuitive, and goes much further than the previous setup. With BatteryBoost, Nvidia has been working with manufacturers to try and lift the constraints clamped onto the GPU when it's running on the battery alone.

> “IT SQUEEZES PAST THE ONE-HOUR MARK WITH BATTERYBOOST”

When your GPU has a TDP of 110W, that's a lot harder to do with a 100W battery looking after the whole system. Now that the likes of the 970M have a TDP of just 75W OEMs don't have to handcuff the GPU so much when it's away from the mains powered teat.

But that's not all BatteryBoost is designed to do. Working in conjunction with the GeForce Experience application, you can use the same one-click graphics optimisation as normal to set up a specific per-game profile when the laptop is unplugged.

And it doesn't simply drop the settings and hope for the best – BatteryBoost can be specifically set up to target a maximum frame rate. Nvidia has that set at 30fps out of the box, which is seen as the minimum frame rate for games to be playable. That means you aren't wasting GPU and battery power trying to get a few extra frames in-game when 30fps will do.

That's all very well in practice, but how does BatteryBoost work in the real world? Well, first the bad news: without any battery optimisation, MSI's GS70 is only able to play *GRID 2* for 42 minutes. That's not really any great shakes in terms of battery-powered gaming. You need to be hitting an hour at the very least to be able to claim any sort of gaming performance sans-plug.

The GS70 does manage to squeeze by the hour mark with BatteryBoost optimised settings, but only just. With an hour and two minutes of optimised battery life, GFE is clawing back another 20 minutes of gaming time. That's not bad, but isn't the great renaissance of battery-powered PC gaming we might have been hoping for.

There's a caveat here. MSI's GS70 doesn't have the 'Stealth Pro' moniker cos it looks good on the specs sheet, and it sure as hell isn't because of the subtle styling. That red chassis is only ever going to stand out from the crowd. It's because

the GS70 is a little under 20mm thick, which is rather svelte for a gaming laptop. That means the thermal and power constraints are going to be greater than those of its hulking big brother, the GT72.

Still, we're seeing excellent performance numbers, even if it's not the top dog when it comes to gaming battery life. As we've already said, the GS70's 970M graphics card is able to outperform the fastest Nvidia chip from the last generation, the GTX 880M, and generally by between 10 and 15 per cent, too.

> “THIS IS THE FASTEST GAMING NOTEBOOK WE'VE EVER TESTED”

That makes this slimline laptop the fastest gaming notebook we've ever tested. Being able to top 30fps in *Metro: Last Light* is really impressive – the desktop GTX 970M is only able to hit 47fps at the same settings. The mathematically-minded reader might well catch the problem here though – that's not the promised 75 per cent desktop/mobile performance delta we were told. And in practice the mobile version of the GTX 970 is actually around 65 per cent of its desktop brethren. Sometimes it manages to touch 70 per cent in some games, but that's still a little shy of its promised pace. Again though part of that is because this thinner system lacks the thermal performance that might otherwise allow the GPU to boost past the 1,025MHz we saw out of the GTX 970M in the GS70.

We've spent most of this piece talking about the graphics performance – partly because this is a gaming laptop first and foremost, but mainly because it represents our first time with the new mobile Maxwell GPUs. But the rest of MSI's GS70 spec deserves a mention too. This is the top-end version, and as such commands an eye-watering price tag to go with the pair of 256GB M.2 SSDs set up in a lightning-fast RAID array, a full 16GB of DRR3 and a 17.3-inch HD screen. It also has the now-standard Core i7 4710HQ quad-core/eight-thread CPU at its heart to give you quality processor performance to match the GPU.

The build quality is excellent, too. The backlit SteelSeries keyboard is as solid as you could wish, and there is no give in the keys or rattle when you're typing. The GS70 is rarely loud either. Sure, you can sometimes hear the fans whirr up when you're taxing it, but it's never ear-splitting. I'm not a fan of laptop touchpads without dedicated buttons, and this one is no different, but that's about as negative as I can really be about this notebook's design.

I'm more negative about the price though. As blazingly fast as the RAID array is, we don't really feel that's worth paying the extra £330 for this SKU over the £1,400 edition. The GTX 970M is what you want to be paying the cash for, and the less expensive MSI machine will perform just as well in-game. But this is still a lovely machine (colouring aside), and outperforms every other notebook – including the similarly-priced dual-GPU Aorus X7 – in our battery of gaming tests. ■ **Dave James**

PCFormat Verdict

Features	★★★★★
Performance	★★★★½
Value	★★★½☆

A seriously expensive, powerful, desirable notebook, with gaming performance in advance of anything we've seen so far.

★★★★½

NO SOUND UNHEARD

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18 www.pegi.info

i(M)(C)12
INTEL® CORE™ i7-5820K
SR20S 3.30GHZ
COSTA RICA
3429A709 (e4)
2W423006A0371
0371
R3

£282 PROCESSOR

INTEL CORE i7-5820K

The missing link between Haswell and Haswell-E has been found...

VITAL STATISTICS

Price £282
Manufacturer Intel
Web www.intel.com
Socket Intel LGA 2011-v3
Core technology Intel 4th Gen Core
Clockspeed 3.3GHz
Turbo 3.6GHz
Cores 6
Threads 12
Lithography 22nm
Cache 15MB
TDP 140W

The top end of Intel's Haswell-E platform is where all the finest new technology from this generation of performance computing lies. When you've got the fastest PCIe-based storage connections, a brand new generation of system memory and a full eight-core consumer processor pulling it all together, that's the pinnacle of today's PC tech right there.

Quite rightly then, the Core i7-5960X, with its 16 threads of processing power, got all the initial headlines. But for us, this bargain-priced six-core Core i7-5820K is the most interesting CPU of this latest chip generation.

We're penny-pinchers here at *PC Format* y'see – our meagre salary allows for but one bowl of subsidised Soylent Gruel to sustain ourselves each day – so the prospect of the cheapest Intel six-core processor ever is a tantalising one. Last generation's Core i7-4930K, of second-tier Ivy Bridge-E fame, was the previous winner of that dubious accolade, though was still a £500 processor at the time of launch.

The Core i7-5820K, however, is £200 cheaper than the older silicon – and considerably quicker too. In fact, it's also quicker than Ivy Bridge-E's top CPU, the Core i7-4960X, and that is still an almost £800 processor. The 5820K is a CPU of full Haswell-E stock, sharing the same silicon DNA as the top eight-core 5960X. So, it's still the same 22nm 4th Gen Core architecture and fits in the same advanced X99 platform as its bigger brothers.

All you're missing out on compared to either the i7-5960X is those two cores, 5MB of cache and 12 PCIe lanes. Compared with the £450 i7-5930K (the similarly six-core middle child of the three Haswell-E siblings) you're just getting a *slightly* slower chip with fewer of those PCIe lanes.

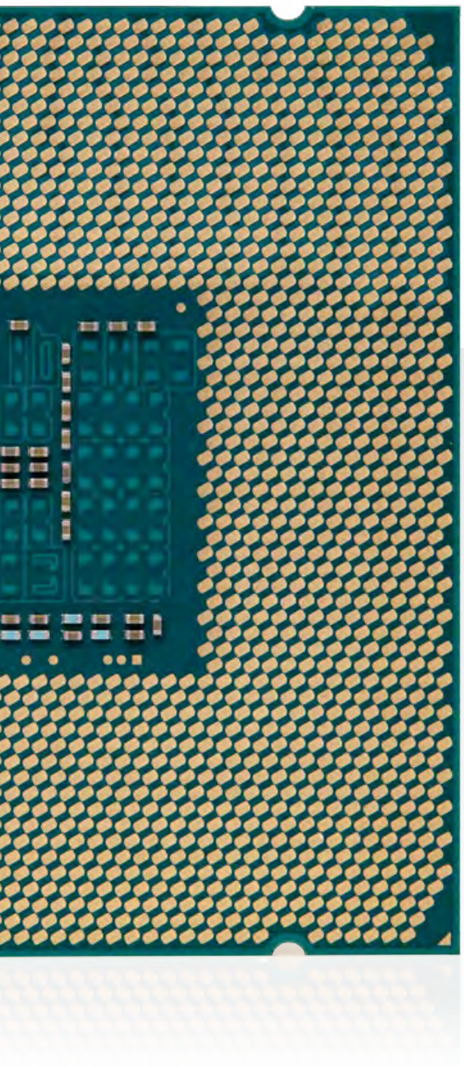
What we're getting at here is this processor is still seriously powerful. We're talking about proper advanced Intel silicon, and it's retailing for only a little more than the quad-core Devil's Canyon processors from the latest standard Haswell refresh.

Chips aren't free

But affordable six-core CPUs are nothing new, right? After all, you can get an AMD six-core processor for just £75 right now.

However, what AMD considers six-core isn't the same as the way Intel counts cores; if it was, we'd be talking about the 5820K being a 12-core chip. The modular CPU design brought in with Bulldozer was essentially AMD's take on Intel's HyperThreading, but with just a little more actual silicon added to the multithreaded mix. But AMD looks like it has seen the error of its ways and is likely to be switching back to a more traditional CPU design when its Zen architecture finally sees the light of day a few years from now.

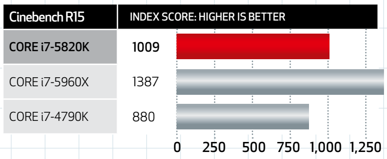
The most intriguing part about this latest range of Extreme edition chips is that we're finally seeing a more linear path from Intel's lower order CPUs right through to its top, £800 behemoths. Before there was a big price jump up



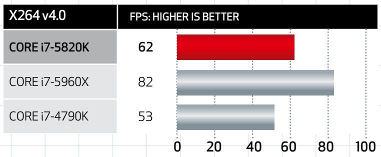
Technical analysis

The eight-core 5960X is evidently the processing king, but the far cheaper 5820K isn't far behind at all. In gaming terms though the vast majority are GPU-bound, so offer little performance difference. The 5820K is a decent little overclocker too, hitting a comfortable 4.45GHz, topping the 4.375GHz the 5960X achieved and even running at 4.7GHz the Devil's Canyon 4790K can't close the processing gap.

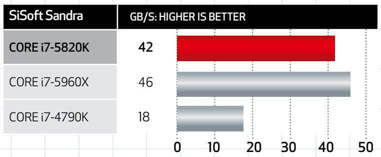
CPU rendering performance



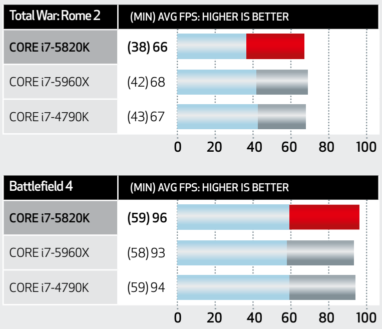
CPU encoding performance



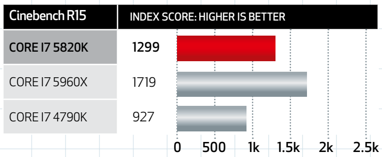
Memory bandwidth performance



DirectX 11 1080p gaming



Overclocking performance



from the likes of an Ivy Bridge quad-core up to an Ivy Bridge E six-core, with an extraneous, expensive quad twiddling its thumbs awkwardly in between the two. With the i7-5820K being just £30-40 more expensive than the i7-4790K anyone who was looking at the top Devil's Canyon CPU for their machine now has an interesting choice to make regarding their PC's platform.

We're not going to pretend that's the only price difference between a decent Haswell setup and the Extreme edition version, but without having to sacrifice any real performance you can build a six-core X99 setup for just £100 more expensive than a quad-core Devil's Canyon Z97 machine. Prices of DDR4 are high, but when you're looking at dropping 16GB of RAM into your rig – which is something you'd probably want to do if you're going to utilise the productivity power of the 12 processing threads – there's not a great difference between 16GB of 1,600MHz DDR3 and 16GB of 2,133MHz DDR4. If you go for the basic, but powerful Crucial kit we checked out a couple of issues back, the difference can be less than £20.

So if the sorts of things you do with your PC are going to use the processing power that a bona fide six-core CPU can offer, like AV manipulation/creation or heavy rendering tasks, then the i7-5820K is an incredibly good value piece of technology. The processing and memory performance of the X99 platform is so far in advance of a Z97/4790K combo the £100 premium looks like a winner.

But if you're more likely to be cutting down Uruks in Mordor than creating masterpieces in Premier Pro, then the extra expense is likely to be wasted. Current game engines still can't make use of the extra core count of something like the 5820K, and so you don't see any real performance increase for your extra spend. And don't get us started on what little difference system memory makes in-game.

> "A SIX-CORE SETUP IS JUST £100 MORE THAN A QUAD-CORE DEVIL'S CANYON"

Money for nothing

But what about multi-GPU setups? With the extra PCIe lanes of Haswell-E, surely an SLI / CrossFireX rig will perform better on an X99 with an Extreme edition CPU, right? You can see where we're going here. Because the 5820K still only has 28 PCIe 3.0 lanes it's not able to run a pair of cards at x16 speeds, only the 5930K and 5960X can do that with their 40 lane capacities. But given PCIe 3.0 offers way more bandwidth than our cards use there's actually little performance difference between running with both cards at x8 speeds as at x16.

If you're chasing the diminishing returns of a three-way GPU setup, however, the 5820K will ensure you get x8 performance on all three rather than one defaulting to a struggling x4 speed. That is an incredibly small niche of computing though, and the only place where a 5820K can really get the jump on Devil's Canyon in terms of gaming.

The future of multi-core performance looks set to get a helping hand with DirectX 12 next year though, and that might be enough for those looking to build a future-proof machine right now. This powerful six-core CPU isn't going to be superseded anytime soon – Broadwell-E has been pushed back to 2016 – and with this platform in place you'll have serious high-end processing power for years to come. ■ **Dave James**

PCFormat Verdict

Features	★★★★½
Performance	★★★★½
Value	★★★★½

A bargain-priced, super-powerful processor that will stand the test of time against the quad-core competition.

★★★★½

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PC GAMER EDITOR'S CHOICE
CUSTOM PC EXTREME ULTRA
PC Format Gold

3XS X99 Carbon

- Intel Core i7 5820K Overclocked to 4.25GHz
- 4GB NVIDIA GeForce GTX 980
- 16GB Corsair Vengeance DDR4
- 500GB SSD + 2TB HDD

The Carbon is our most affordable X99 system, featuring a 6-core Intel Core i7 5820K which is water-cooled and overclocked to 4.25GHz. Graphics are provided by a super-fast 4GB NVIDIA GeForce 980 graphics card. Also included is 16GB of 2666MHz Corsair Vengeance DDR4, an Asus X99-S motherboard, a 250GB Samsung 850 Pro SSD and a 2TB hard disk.

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- 8GB Corsair Vengeance DDR3 1600MHz
- NVIDIA GeForce GTX 860M
- 1TB HDD
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3XS Z97 Performance GT
- Intel Pentium G3258 overclocked to 4.4GHz
- 8GB Corsair Vengeance Pro 2133MHz
- 2GB NVIDIA GeForce GTX 760
- 1TB HDD

£599

GAMING EXPERIENCE:
ELITE
★★★★

Our 3XS systems have been engineered to give you an edge over your competitors in the latest games. Each model has the perfect blend of cutting edge components to help you pwn noobs without breaking into a sweat.

3XS Z97 OC10
- Intel Core i5 4690K overclocked to 4.6GHz
- Asus Z97-K motherboard with SLI and CrossFireX
- 8GB Corsair Vengeance Pro 2133MHz
- Phanteks U-Type

£409

Scan 3XS Graphite LG1711
- Intel Core i7 4710M
- 8GB Corsair Vengeance DDR3 1600MHz
- NVIDIA GeForce GTX 870M or 880M
- 1TB HDD
- 17.3in 1920 x 1080 screen

£1065

3XS Z97 Performance GTK5
- Intel Core i5 4690K overclocked to 4.6GHz
- 8GB Corsair Vengeance Pro 2133MHz
- 4GB NVIDIA GeForce GTX 970
- 240GB SSD
- Water-cooled whisper quiet

£999

GAMING EXPERIENCE:
GODLIKE
★★★★★

Unlock your true gaming potential with one of our 3XS systems. These no compromise systems provide the very best in frame rates in games thanks to their combination of overclocked CPUs and graphics cards.

3XS Z97 OC15
- Intel Core i7 4790K overclocked to 4.6GHz
- Asus Republic of Gamers Maximus VII Ranger
- 8GB Corsair Vengeance Pro 2133MHz
- Corsair water-cooler

£549

Scan 3XS Graphite LG1715
- Intel Core i7 4710MQ
- 16GB Corsair Vengeance DDR3 1600MHz
- Dual NVIDIA GeForce GTX 780M in SLI
- 1TB HDD
- 17.3in 1920 x 1080 screen

£1669

PC GAMER
EDITOR'S CHOICE
★★★★★
HEXUS
PERFORMANCE

3XS Z97 Vengeance 980
- Intel Core i7 4970K overclocked to 4.7GHz
- 8GB Corsair Vengeance Pro 2133MHz
- 4GB NVIDIA GeForce GTX 980
- 250GB SSD + 2TB HDD
- Water-cooled whisper quiet

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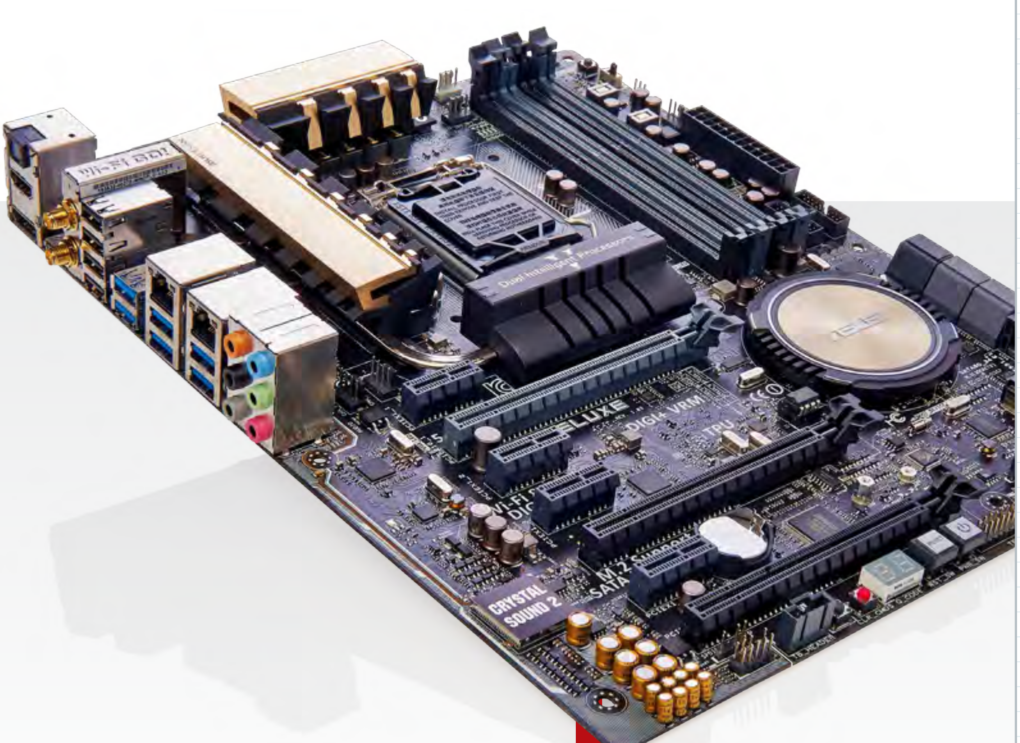


£285 MOTHERBOARD

ASUS Z-97 DELUXE

A Z-97 motherboard with a bundle that has to be seen to be believed

VITAL STATISTICS

Price £285
Manufacturer Asus
Web www.asus.com
Socket support Intel LGA 1150
Chipset Intel Z97 Express
Memory support 4x DDR3 DIMM up to 3,300MHz (OC)
Max memory supported: 32GB
Storage 10x SATA 6Gb/s, 1x M.2, Dual SATA Express

We know what you're thinking: £285 for a non-RoG or TUF motherboard? What are the bods at Asus thinking (or indeed smoking)?

This is the most expensive Z-97 board in the current Asus lineup, but the moment you pick up the box, its sheer weight tells you you're holding something a bit special.

With the Z-97 Deluxe (NFC & WLC), Asus has taken the motherboard bundle to whole new level. You get a ThunderboltEXII/Dual, (Asus's dual-port Thunderbolt 2 add-in card) and all the cables for it, a NFC Express 2 box and a wireless charger, its accompanying power adapter, and all the cables for that, too. The standard Z-97 Deluxe is around £200, which means all these extras cost just £85. In a weird, twisted sort of way, that makes the NFC & WLC version a bargain.

All this comes with one of the most feature-rich Z-97 boards you can buy. Starting with the storage options Asus covers most bases with 10 SATA 6Gb/s ports, two SATA Express ports and, last but not least, an M2 Socket 3 slot supporting both 2260 and 2280 formats.

There are a few caveats to be aware of with all of this though. For starters not all 10 SATA ports are available at the same time; depending on which ones are being used others are disabled. Complications arise as well if you want to use the M.2 slot and SATA Express ports simply because of the limited number of PCI-E lanes provided by the chipset.

Well connected

If you have lots of USB devices needing a home, this is the board for you. It has 10 USB 3.0 ports (six on the rear I/O panel plus four via headers on the board) and eight USB 2.0 (four on the I/O panel and four via headers) ports.

The board comes with three PCI-E x16 slots; the top two are to the 3.0 specification running at full x16 speed as a single slot, or dual x8 if both slots are filled. The third slot is 2.0 spec, running at a maximum speed of x4. The board supports both AMD three-way CrossFireX and Nvidia Quad GPU setups. Rounding things out are four PCI-E 2.0 x1 slots.

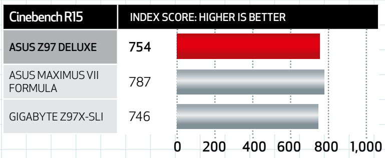
Asus is at the leading edge when it comes to bringing fully featured UEFI BIOSes to the table. The Z-97 Deluxe (NFC & WLC) uses the latest version of its graphical masterpiece, which even has animations for showing fan speeds and board temperatures. The opening screen features Asus's Easy Mode which has some basic click and set performance tweaks and for a bit more in-depth overclocking there is the Easy Tuning Wizard, which asks you some questions and tunes your system accordingly This way of overclocking does lean to the conservative side of what's possible, but it's a valuable tool for people who want their system to run faster but are put off by complicated BIOS screens.

Then there's the updated Five-Way Optimization feature, which lets you tune the board dynamically with a single click. This includes overclocking, energy saving, power settings, controlling fans for lower noise levels, and even networking and audio options. ■ **Simon Crisp**

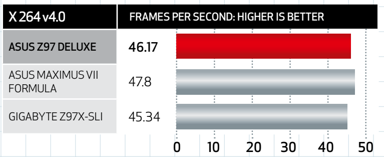
Technical analysis

The BIOS has an overclocking option for every kind of user. If you want to make small adjustments, there's an Easy mode. If you want to go a bit deeper but still not get too involved, you can try the Easy Tuning Wizard, and if you really want to get your hands dirty, then there are more tweaking options here than you can shake a big sticky thing at.

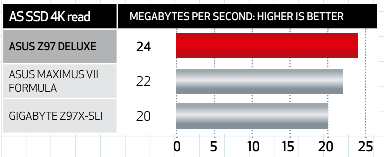
CPU rendering performance



Video encoding performance



Storage performance



PCFormat Verdict

Features	★★★★★
Performance	★★★★☆
Value	★★★★☆

Yes it's eye-wateringly expensive and may be more than you need, but this is the most complete Z-97 package currently available.

★★★★½

£600 MONITOR

AOC U3477PQU

Super wide, seriously dramatic, sadly pricey

VITAL STATISTICS

Price £600
Manufacturer AOC
Web www.aoc.com
Panel size 34-inch
Panel technology IPS
Native resolution 3,440 x 1,440
Refresh rate 60Hz (at native res)
Response 5ms GTG
Inputs DisplayPort 1.2, HDMI, DVI-D, D-sub

We're so over 4K. That first rush of super high-res 4K screens were pretty exciting, but only because they were offering a new resolution we hadn't seen before. Now those 4K screens are securely packed away in the kit cupboard because there's a new wide-boy in town: AOC's U3477Pqu.

Our big problem with 4K screens is that there isn't the content yet to justify the step up in resolution and resulting step down in performance. Realistically, moving from a 1440p screen to a 2160p one doesn't currently offer anything other than a drop in frame rates. Your in-game textures are still generally the same scale and won't deliver the visual fidelity promised by the 8MP 4K resolution.

Making the move to a 21:9 aspect ratio though makes a difference that 4K can't yet match. This 34-inch, 3,440 x 1,440 monitor makes for a dramatic gaming experience, but is usable for 'normal' computing too. Early 29-inch 21:9 screens were only 1,080 pixels high, which was far too short to make for a compelling experience outside of gaming. Switching to a 1,440 pixel height though makes even more of a difference than we thought it would.

Wide awake

The extra demands the super-mega-widescreen native resolution puts on your GPU are nowhere near the frame-rate killing level of 4K. At 2,560 x 1,440 you've got around 3.7MP versus a little under 5MP for the 3,440 x 1,440 res of the AOC. Yes, you will see bit of a performance hit, but not a huge one.

In-game, with that almost wraparound resolution filling your vision, you'll forget about 4K. It's strange, pulling you more fully into the gameworld than the traditional 16:9.

This isn't the first of the new 34-inch, 21:9 screens we've seen. The LG 34UM95 turned us on to this aspect ratio, but partly because of its Apple-pleasing features like Thunderbolt, it commanded an almost £800 price tag. At around £200 less, the AOC is a better value proposition. It's still very expensive, but AOC seems to have turned a corner recently and is putting out quality monitors, rather than just cheap ones.

Out-of-the-box image quality has been an issue with past budget AOC screens, but the IPS panel used in the U3477Pqu is excellent. The colours and contrast are great as soon as the monitor powers on, and the gradient and white reproduction are similarly good. The black levels get slightly crushed at the lower end, but that is being picky.

The chassis is well made, too. There's a minimal bezel around the outside of the panel, and the physical buttons on the underside are far easier to use than the touch-sensitive ones some recent screens have shipped with. The OSD is old-school AOC fare, though: functional but little more.

We'd hoped the U3477Pqu would be around the same sort of price as AOC's 4K TN monitor, but it's closer to the expensive RoG Swift PG278Q. That's a shame, but you'll probably forget about that as soon as you start stalking around Sevastopol with a motion tracker. ■ **Dave James**

PCFormat Verdict

Features	★★★★½
Performance	★★★★½
Value	★★★½☆

A great-quality panel, offering a really dramatic upgrade from 1440p, but with a super-sized price tag to boot.

★★★★☆

£60 GAMING HEADSET

SHOGUN BROS ENSENSE

The mouse maestro plunges into audio territory

VITAL STATISTICS

Price £60
Manufacturer Shogun Bros
Web www.shogunbros.com
Frequency response 20Hz – 20KHz
Sensitivity 113dB
Connection type USB
Driver size 50mm
Mic sensitivity -38dB

First, a bit of background on Shogun Bros, a relative newcomer to the scene. We love its Ballista Mk-1 mouse, and so had high hopes for the first headset to bear its name.

Admittedly those hopes faltered a little upon learning it's called the Ensense (we're just going to refer to it as the Nonsense from now on, okay?) and boasts similar 'force feedback for your ears!' tech to Mad Catz's F.R.E.Q. 4D cans. Still, a company that put out such a stellar mouse can't have got it totally wrong, can it?

No. Far from it. Certain aspects of the Nonsense's performance are really impressive considering its £60 pricing, particularly the virtual 7.1 surround sound. We were blown away by the precise and spacious audio positioning as we ran through our usual array of binaural mic recordings and the headset's own bundled calibration software. It lacks the 'scout mode' setting we're seeing in many high-end gaming headsets these days, which boosts nearby sound cues (y'know, to cut down on back-stabbing and suchlike), but is otherwise among the best we've heard at delivering virtual eight-point sound. That's saying something in territory as affordable as this.

Hear me roar

Build quality is as you'd expect for the price, so it's sturdy but not all that malleable, and lacks rotational adjustment. Bonuses include a braided cable and voice manipulation software that *has a dinosaur mode*. This and the software suite its part of are welcome additions and usually found in much pricier packages.

The drivers in each earcup measure a huge 50mm. They're certainly capable of throwing out some meaty low-end, so out-of-the-box sound quality is pretty good. That's the good news. The bad news is that said meaty low-end is harnessed for the Ensense system, an accentuated vibration designed to enhance explosions and gunfire in shooters, promising a "realistic sensation". Come on, Shogun Bros, you're not selling Fleshlights here, and we're not looking to get an ear massage while we play *BF4*. We just want our games to sound good.

That face-shuddering bass you and Shogun Bros are both after? That only happens when closed-cup earphones literally close off external sound and make contact with your head at every part of the contact pad. Within that little vacuum, sub-bass harmonics are able to disrupt the air so much they literally push the contact pad off your head a little bit. The explosion goes off in-game, and it feels like the shockwave just pushed your headset outwards. That's the theory.

The Nonsense's earcups have a pentagonal shape, and the cushioning is fairly firm. As a result, external sound isn't cut off, and though it's capable of throwing out powerful sub-bass, it escapes no matter which setting you use. In short, there are reasons to buy this headset, but the haptic effect is absolutely not one of them. Instead, buy the Ensense (we'll relent just this once) because of its fantastic surround sound, solid build quality and dinosaur voice mode. And other manufacturers: stop trying to shill us snake oil 'tech' like Ensense and 4D sound, deal? ■ **Phil Iwaniuk**

PCFormat Verdict

Features	★★★☆☆
Performance	★★★½☆
Value	★★★★☆

Luckily the vibration enhancing can be turned off, revealing wonderful surround capability at an attractive price.

★★★½☆

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£469 GRAPHICS CARD

GTX 980 SUPER JETSTREAM

What's so super about this 'ere JetStream then?

VITAL STATISTICS

Price £469
Manufacturer Palit
Web www.palit.biz
GPU Nvidia GM 204
SMMs 16
CUDA cores 2,048
Base clock 1,203MHz
Boost clock 1,304MHz
Memory capacity 4GB GDDR5
Memory speed 7.2Gbps
Memory bus 256-bit
ROPs 64

Nvidia's fresh spin on the Maxwell GPU architecture has created a pair of graphics cards – the GTX 980 and GTX 970 – that are offering seriously impressive levels of efficiency and gaming performance. Last month we got all excited about the overclocked GTX 970 from Gigabyte, and now it's time for the GTX 980 to get some factory-overclocked loving from Palit.

The Super JetStream uses Palit's latest air-cooling tech to chill the GM 204 GPU with a pair of chunky fans, and gives both the graphics chip and memory a slight boost out of the box. There's also a vanilla JetStream, which uses the same cooling array but with the reference GPU and VRAM clocks for a little less cash.

The GM 204 gets a boost of just 77MHz to its base clock, and a lift of 200MHz to the effective memory frequency. The stated turbo offers a bit more, but we found the Super Jetstream to be running at around 1,328MHz. The extra thermal performance allows the GPU to keep a higher clockspeed than expected.

It's all so quiet

That gives it a bit of a step up from the reference GTX 980, but only by a few frames per second on average. The bonus is the cooler, which runs its twin fans in a 0dB profile that means they don't even start to spin up until the GPU hits 65°C. Without heavy loads your graphics card stays silent, and even when the cooler does spin up, those large, efficient fans remain extremely quiet, spinning at around 1,000RPM.

You're not going to get the same sort of cooling we saw on Gigabyte's super-chilled GTX 970 G1 Gaming, but the 77°C maximum temperature is still pretty low considering this is a high-performance GPU running under load.

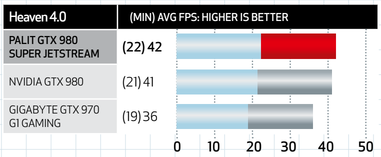
Sadly though, the extra cooling doesn't mean you're going to suddenly find yourself able to push the GM 204 way above what the reference card can do with its Titan-esque cooler. As we suspected with the reference card, the overclocking limits are more to do with the constraints of the silicon than the efficiency of the thermal designs. We could only get stable performance out of our reference GTX 980 up to 1,480MHz, and the same rings true with this Palit version. Often, the hope with factory-overclocked cards is that you'll be able to hit higher performance as they'll be using specially picked silicon. It's a shame that's not possible here, but not a huge surprise.

It does mean that this Super JetStream doesn't really have much of a place in the market. The standard JetStream is some £20-odd cheaper and still has the excellent cooling array in place. All you're missing is the slight GPU and memory overclock, which you can easily add yourself. That's probably the card we'd be looking towards right now if we were in the market for a well-priced GTX 980. The cooling is making a tradeoff for silence over super-low thermals, but the Maxwell GPU is already pretty cool under load anyway. We'd rather have our machines sounding less like a jet and more like a jetstream. ■ **Dave James**

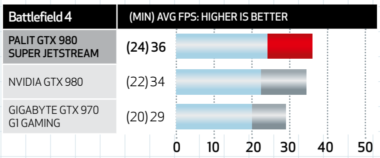
Technical analysis

The GTX 980 Super JetStream is able to post slightly higher performance numbers to go along with its slightly higher clockspeed. Even so, those paltry extra fps aren't worth the price hike over the reference-clocked standard JetStream card from Palit.

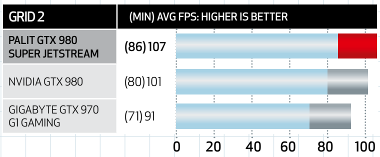
DirectX 11 synthetic performance (1600p)



DirectX 11 gaming performance (4k)



DirectX 11 gaming performance (1600p)



PCFormat Verdict

Features	★★★★★
Performance	★★★★½
Value	★★★☆☆

The lack of any real performance boost means we'd rather have the straight JetStream version over this 'Super' option.

★★★★☆

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Computer Shopper - 5 Stars
Expert Reviews - 5 Stars
PC Format - Gold Award
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Gold PC Format Gold

PC GAMER EDITOR'S CHOICE ★★★★★

expert REVIEWS ★★★★★

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£40 CPU COOLER

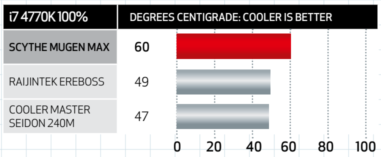
SCYTHE MUGEN MAX

Scythe's latest addition to the Mugen range is large, quiet and performs well

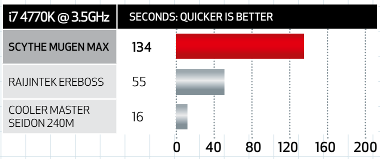
Technical analysis

We've put the Mugen Max up against the excellent push-me-pull-you design of the Ereboss and the liquid-chilled Seidon for comparison. The Scythe cooler holds up well, but the extra fan of the Ereboss helps it stay out in front as the top air-cooler of the two.

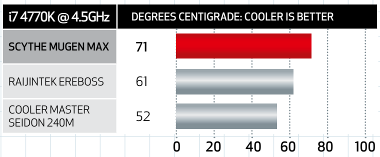
Stock-clocked performance



Peak-to-idle performance



Overclocked performance



VITAL STATISTICS

Price £40
Manufacturer Scythe
Web www.scythe-eu.com
Intel socket compatibility 775, 1150, 1155, 1156, 1366, 2011
AMD socket compatibility AM2, AM2+, AM3, AM3+, FM1, FM2. FM2+
Base plate Nickel-plated copper
Cooling fans 1 x 140mm
Dimensions 145 x 86 x 161mm

The latest addition to Scythe's high performance Mugen range is the Max – a very apt name for such an impressively sized lump of a PC cooler.

Perhaps the most surprising thing about the Mugen Max is its relative lightness; despite its 145 x 86 x 161mm size (and that's without the 140mm fan) it weighs in at 720g. This may still sound like a lot, but for a cooler of this size you would normally be looking at something closer to, or even exceeding, a kilogram.

The cooler block's contact plate is made from nickel-plated copper, as are the six 6mm heatpipes that run through it (these heatpipes are not in direct contact with the CPU). To aid cooling even more, there are a couple of small heatsinks built into the top of the CPU block itself, which feed through a 39-finned cooling stack.

In a clever bit of design from Scythe, the cooling plate has been moved a little off-centre, which should allow for more clearance for the taller memory modules currently available. However, every silver lining has a cloud and this design makes mounting the cooler a bit problematic.

The first part of the process – fixing the motherboard backing plate and the cooler mounts – is a doddle, aided by the simple but thorough single sheet of instructions.

However when it's time to fix the cooling matrix using the central mounting bar, things get tricky. Although one fixing nut is very easy to reach, the other one is a complete pain – especially if some of the motherboard's VRMs are in close proximity to the CPU socket. Scythe supplies a little spanner for the job, but attempting to hold the cooler in place while at the same time trying to get the nut started would quite frankly test the patience of Houdini. By far the easiest way is to pass a screwdriver through a hole in the cooling stack, but you'll be needing a long-shafted job to get to the fixing nut. No innuendo intended

Slow and steady

To keep the noise down, Scythe has used one of its own GlideStream 140mm PWM fans. A large fan like this serves two purposes: it allows a large volume of air to be shifted around (Scythe quotes 97CFM of air) helping to keep things chillier, and because it spins more slowly than a smaller fan, it's very quiet. In this case it goes from just 500rpm up to 1,300rpm, with resulting quoted noise levels of between 12 and 30.7dBA. In normal use it is certainly very quiet. Near silent, in fact.

Both the large fan and cooling matrix give the Mugen Max pretty good performance, and thanks that 140mm fan it goes about its job very quietly. It kept an i7-4770K at 24°C while idling, and with the CPU at 100 per cent loading kept it at 60°C. When the CPU was overclocked to 4.5GHz, the cooler took things pretty much in its stride, keeping the CPU at 66°C when idling.

However, when pushed at 100 per cent the CPU did get a little on the warm side at 71°C. You might not want run it for too long at this temperature, but even then the fan was barely audible. ■ **Simon Crisp**

PCFormat Verdict

Features	★★★★☆
Performance	★★★★☆
Value	★★★½☆

If you need a cooler for a quiet PC in a standard sized case then Scythe's Mugen Max should be near the top of your list.

★★★★☆

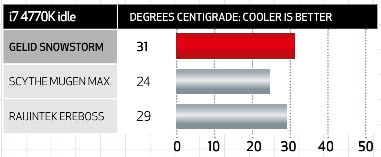
SnowStorm
GELID
solutions
CC-SnowStorm-01
AS9225L12-PWM
www.gelidsolutions.com
Made in China

£17 CPU COOLER

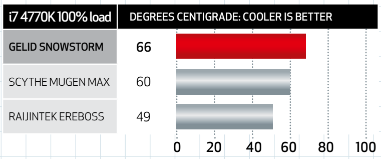
Technical analysis

We used RealTemp to monitor the CPU's core temperatures at idle and peak. To max out the CPU at 100 per cent, we ran the Small FFT's test in Prime95. For both tests we left the CPU to run for 20 minutes. The SnowStorm could handle everything except running the CPU overclocked, where the temperature climbed past 100°C in a under a minute.

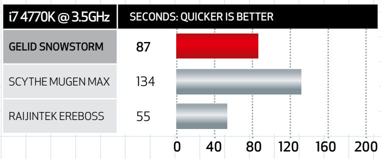
Stock-clocked performance



100% load performance



Peak-to-idle performance



GELID SOLUTIONS SNOWSTORM

Cheap as chips, works well and is pretty near silent with it

VITAL STATISTICS

Price £17
Manufacturer Gelid Solutions
Web www.gelidsolutions.com
Intel socket compatibility 775, 1150, 1155, 1156, 1366
AMD socket compatibility AM2, AM2+, AM3, AM3+, FM1, FM2. FM2+
Base plate Nickel-plated copper
Cooling fans 1 x 92mm PWM
Dimensions 102 x 73.1 x 138mm

When you glance at its price tag, its size (it weighs a mere 372g) and its tiny cooling fan (just 92mm), you might assume that Gelid's latest addition to its Silent range of CPU coolers might not be up to much. Looks can be deceiving though, and it turns out the SnowStorm is a rather good performer in normal situations.

Gelid has built the SnowStorm with a unique fin architecture that allows the air to flow equally to all parts of the heatsink. The three copper heatpipes are of a direct contact design, meaning the pipes pass through the base of the contact plate and are flattened to make direct contact with the CPU. According to Gelid, this grants the SnowStorm better cooling performance.

The 92mm PWM cooling fan uses a Hydro Dynamic Bearing, is rated at 39CFM, and spins from 900rpm up to 2,200rpm. It gives quoted noise levels ranging from 10 to 24.1dBA and it certainly is pretty quiet even when pushed to (and beyond) its limits.

Push it

The SnowStorm is incredibly easy to install thanks to its simple, no-nonsense mounting system. Well, 'system' is quite a strong word to use for a backplate, four threaded screws, four nuts and sprung bolts, but it works. The absence of fancy bits and pieces all help to keep the price down, too. Another point in its favour is the fact that its mounting design means you don't have to worry about taking the fan off the cooler matrix before installing, speeding up the install time. Every little helps.

A quick glance at Gelid's website shows that the most powerful Intel CPU family supported by the SnowStorm is Intel's Core i5, so you might think keeping a Core i7 cool would be a bit beyond its capabilities. However, as we like to push both the envelope and manufacturers' recommendations, we tested it with a Core i7 anyway. Not just any old i7 either, but a full-fat Intel i7-4770K.

To its credit, the SnowStorm coped rather well, at least at standard speeds. At idle it kept the CPU down at 31°C, which isn't too shabby, and with the CPU maxed to 100 per cent it kept it at 66°C. That's pretty impressive – especially for something aimed at a Core i5 at the most. To put that 66°C into some kind of perspective, it's just six degrees warmer than the much larger Scythe Mugen Max managed when tested with the same CPU.

When it came to trying to keep the i7-4770K cool when overclocked at 4.5GHz, the SnowStorm finally showed its limitations. It could keep the CPU at 47°C at best when idling, which again is not so bad for a cooler of this class. However, once the CPU was set to run at 100 per cent all bets were off as the temperature went passed 100°C in just a few seconds.

This came as no real surprise; the SnowStorm is designed for very quiet operation, after all, not high performance. No, the surprise was that it could keep a Core i7-4770K cool enough in normal everyday conditions in the first place. ■ **Simon Crisp**

PCFormat Verdict

Features	★★★⯪☆
Performance	★★★★☆
Value	★★★★⯪

A no-brainer for those on limited budgets with no plans for serious overclocking, and Gelid backs it with a five-year warranty.

★★★★☆

£120 KEYBOARD

MAD CATZ S.T.R.I.K.E. TE

Because the neighbours need to know you're playing games

VITAL STATISTICS

Price £120
Manufacturer Mad Catz
Web www.madcatz.com
Keyboard tech Mechanical switch
Macro keys 12
Backlighting Multi-zone
Extras None

Mad Catz jumps on the mechanical switch keyboard bandwagon with a curiously shaped slab of matte, soft-touch plastic over a metal frame that's heavy enough to stay in place on a desk and probably do some damage if swung hard enough.

There's a gap at the top of the S.T.R.I.K.E. TE that simply serves to make it look like a gun, and the tapering shape and illusion that the numpad is detachable help underline this. Its aggressive looks are ruined by the hard wrist rest, but you can leave this off to convince your mates you're typing on a futuristic laser weapon (it doesn't clip on firmly anyway).

Good backlighting is essential for atmospheric gaming, and the S.T.R.I.K.E. TE doesn't disappoint. The white lighting is strong and sharp against the black key, and easily shows up even in a room filled with sunshine. Software allows you to alter the backlighting level across the keyboard, or just on the [W][A][S][D] and/or arrow keys. You can have [W][A][S][D] at a much brighter level than the rest of the board, or turn the rest off entirely. It's a shame this can't be extended to cover gaming staples such as [Alt], [Shift] and the number keys though.

The lighting can be cycled through three modes with a button that's programmed via the downloadable app. This also provides the macro key programming interface, which is a drag-and-drop affair that's simple to use.

Preset commands such as window minimising and web page bookmarking can be bound to a key, and you can bind game-specific commands up to 255 characters long too. There are ready-made profiles for 25 games available.

There are seven M keys at the top left and five C keys around the arrows ready for tweaking, and as the mode key changes the custom key bindings as well as the lighting, this makes for a great deal of potential customisation. A simple switch disables the Windows key whenever you want to make sure you don't clip it by mistake – a thoughtful touch.

Softly, softly

The keys themselves are sat on Kailh Brown mechanical switches. They activate after less than half their travel, which means there's plenty of time for you to release them before they bottom out. You might not want to do this, however, as the sound a mechanical keyboard makes is part of its charm. The keys' action is quite soft, with no sense that your finger is being pushed up from underneath.

The keys sit high on their switches, making them an acquired taste. You can use the wrist bar or the solid two-position feet at the back of the keyboard to reposition it for more comfortable typing. The keytops aren't slippery, but the decision to place the shifted character next to the main one rather than on top means you may struggle to find the apostrophe – which is upside down – and the semicolon, which looks very similar to its sibling. Assuming you use it for anything other than gaming, that is.

The TE builds on Mad Catz' existing S.T.R.I.K.E. range of peripherals, and is a solid, if unremarkable, entry to the world of mechanical switch keyboards. ■ **Ian Evenden**

PCFormat Verdict

Features	★★★☆☆
Performance	★★★★☆
Value	★★★☆☆

Responsive, customisable and noisy, but nothing out of the ordinary. Gigabyte's Aivia Osmium offers more for less.

★★★☆☆

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£70 MOUSE

RAZER TAIPAN

Snake? Snaaaaaake? No, wait, it's a mouse…

VITAL STATISTICS

Price £70
Manufacturer Razer
Web www.razerzone.com
Sensor 8,200dpi 4G laser
Buttons 8
Handed Ambidextrous
Switches Omron
Processor 32-bit ARM
Connection Wired

Would it be acceptable to compare a mouse to a Porsche? No it absolutely would not, but the designers of the Razer Taipan have taken their cues not from the world of snakes, but from the sort of thing that makes James May weak at the knees.

The two textured rectangles either side of the cord at the front are reminiscent of the twin front intakes low down on a Ferrari Enzo or Lamborghini Gallardo, while the shape of the main body brings to mind the sweep of the roof on the hard-top F-type Jag.

The wheel (which lights up) even has a ridged rubber ring like a tyre, and the rubber pads on the sides of the mouse have a pattern to them that's half tyre tread, half snakeskin.

Right, that's quite enough of that nonsense. This is a large, eight-button mouse that fits nicely in a reviewer's big hand, with the frontmost side switches falling right under the thumb and third finger, and its main buttons part of the top covering. Their sides are ridged to prevent your fingers slipping off, if that's a problem for you. Its symmetrical shape means it's ambidextrous, too.

The Taipan is suited to FPS and RTS games thanks to its precise 8,200dpi sensor and programmable buttons. By default, sensitivity can be adjusted through two buttons just behind the wheel, in a hard to reach part of the mouse that sits between the middle knuckles when your fingers rest on both main buttons. This can be changed, along with the functions of the other buttons, with the Razer Synapse 2.0 software, so if you want your main fire button somewhere you can't easily reach it, that's perfectly possible.

Synapse is faintly annoying in that it forces you to create an account and verify a password before it will let you into the settings. The rationale behind this is the syncing of calibration profiles across machines and the automatic application of firmware updates, but an offline-only option would have been nice.

Smooth sliding

In use, the Taipan proves to be accurate and smooth, slipping across a surface without catching or feeling as if there are rough edges underneath. The buttons, once you've programmed them for your preferences and handedness, aren't all easy to reach, however. With the two main buttons plus the ones under your thumb set to common actions, the buttons that fall under your third fingers can be assigned to rarely used commands, and the ones behind the wheel largely forgotten about unless you need to change sensitivity on the fly. Drop your thumb onto the snake/tyre rubber panel below the side buttons, and you've got a good grip.

A strange evolutionary quirk of this Taipan is its enormous tail. A good seven feet long and nicely braided, the cord seems unlikely to tangle or pull out of its USB port on all but the largest desk.

The Taipan is more than a blinged-out gaming mouse, thanks to its accurate sensor and programmable nature, but it is at heart a refinement rather than a revolution. And to name something after a snake that has clearly been influenced performance cars is absurd. ■ **Ian Evenden**

PCFormat Verdict

Features	★★★☆☆
Performance	★★★★☆
Value	★★★☆☆

A solid, no-nonsense mouse with enough features to make it interesting, but don't expect Naga Epic levels of programmability

★★★½☆

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RIG BUILDER

Whether you're upgrading your PC or starting anew, this is the best kit

One of the joys of owning a PC is that you can upgrade it as you go. Need higher frame rates in games? Drop in a newer graphics card. Want more power elsewhere? Grab a new processor or go for that old favourite: a memory boost. There's a wealth of upgrades that can transform your machine, and you can change slowly over time to suit your budget, so you rarely have to suffer a sluggish rig for long. Every now and then, the best possible upgrade is to dump your current rig and start afresh by building a whole new machine from scratch.

What sort of machine should you build, though? Which items are important? Which work well together? How much should you be budgeting for? That's a lot of questions, and getting the right answers means having to go and research all the current trends in order to make the best decision. Before you do that, though, take a look at our guide. You'll discover that we've taken the hard work out of the equation and presented you with three machines that fit three different budgets.

On these pages are our usual recommendations for putting together a budget, mainstream and silly high-end machine. These rigs all include a screen and peripherals in the ticket price, so if you're keeping your existing goodies then you'll have more cash to spend elsewhere. And what's our recommendation if you find yourself with that pleasant problem? Either get a larger SSD or a more powerful GPU. Happy building you lovely people! ■ **Dave James**

HOW TO...
BUY A MOTHERBOARD

Your choice of motherboard almost entirely dictates what sort of PC you end up with. It will determine whose CPU you go for, and what range you pick it from. It also decides what storage you can use, how many graphics cards you're able to fill out your PC with and, almost more importantly, it dictates how big your final build can be.

The key thing to remember is that you don't *have* to go for a full ATX spec board if you want high performance. A micro-ATX or Mini ITX board can be just as capable of offering serious PC grunt as their larger brethren. You don't have to be restricted on the overclocking front either. Since Intel relaxed the draconian restrictions on overclocking with the Haswell range, you're not limited to the Z-series. In the new line-up both H97 and Z97 allow overclocking, and in the previous generation the lowly B85 chipset could also be tweaked. These days, it's a much more flexible motherboard market.

BUDGET

MOTHERBOARD	
■ Gigabyte B85M-D2V	**£42**
CPU	
■ Intel Pentium G3258	**£48**
MEMORY	
■ Crucial 2x 2GB DDR3 1,600MHz	**£31**
GRAPHICS CARD	
■ MSI GTX 750 Ti OC	**£101**
SOLID STATE DRIVE	
■ Crucial MX100 256GB	**£79**
CPU COOLER	
■ Intel Stock Cooler	**NA**
POWER SUPPLY	
■ SilverStone Strider E 500W	**£44**
CHASSIS	
■ Corsair Carbide 200R	**£47**
OPTICAL DRIVE	
■ LiteOn IHAS124-14 24x DVD±RW	**£12**
SCREEN	
■ AOC E2250SWDNK	**£79**
Total	**£483**

MAINSTREAM

MOTHERBOARD	
■ Asus Z97-A	**£114**
CPU	
■ Intel Core i5-4690K	**£180**
MEMORY	
■ Corsair Vengeance LP 8GB	**£58**
GRAPHICS CARD	
■ Sapphire R9 285	**£170**
SOLID STATE DRIVE	
■ Crucial MX100 512GB	**£150**
CPU COOLER	
■ Enermax ETS-T40	**£28**
POWER SUPPLY	
■ OCZ ModXStream Pro	**£52**
CHASSIS	
■ Cooler Master CM690	**£60**
KEYBOARD	
■ Corsair Vengeance K65	**£65**
SCREEN	
■ Viewsonic VX2370Smh-LED	**£123**
Total	**£1,000**

HIGH-END

MOTHERBOARD	
■ Asus X99 Deluxe	**£236**
CPU	
■ Intel Core i7-5960X	**£769**
MEMORY	
■ Corsair Vengeance LPX 16GB	**£283**
GRAPHICS CARD	
■ MSI R9 295X2	**£700**
SOLID STATE DRIVE	
■ Samsung 840 EVO 1TB	**£389**
CPU COOLER	
■ Thermaltake Water 2.0 Ext.	**£105**
POWER SUPPLY	
■ CM Silent Pro Gold 1000W	**£171**
CHASSIS	
■ CM Cosmos 2 Ultra	**£286**
KEYBOARD	
■ Corsair Vengeance K70	**£120**
SCREEN	
■ HP ZR30W 30-inch	**£922**
Total	**£3,981**

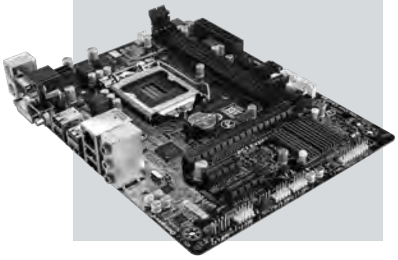
BUDGET

WHEN EVERY POUND COUNTS, SPEND THEM WISELY

MOTHERBOARD

Gigabyte B85M-D2V

This micro-ATX board is the perfect foil for Intel's bargainous Pentium Anniversary CPU, with good connectivity and decent overclocking chops to boot.



CPU

Intel Pentium G3258

Poor AMD, it's a clean sweep for Intel on all our recommended rigs. The new Pentium is simply the best budget chip around, offering Haswell for peanuts.

CPU COOLER

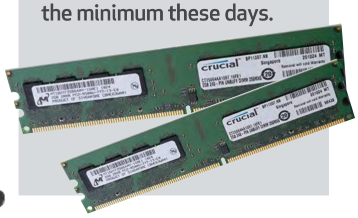
Intel Stock Cooler

The Pentium Anniversary chip is a very cool-running CPU, even when overclocked. We managed a stable 4.2GHz on this stock Intel cooler.

MEMORY

Crucial 4GB 1600 DDR3

Memory pricing continues to be incredibly volatile, but it's still a great time to squeeze more sticks into your rig. You really should see 4GB as the minimum these days.



GRAPHICS CARD

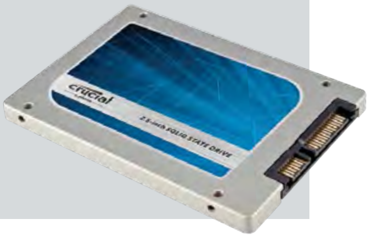
MSI GTX 750 Ti OC

Nvidia's latest GPU is quite a feat of engineering because of that brand new Maxwell architecture. The MSI card is a bargain at this price too.

SOLID STATE DRIVE

Crucial MX100 256GB

The 256GB version may lag behind the 512GB drive, but it's got enough space to be going on with and is much quicker than any HDD you can put it up against.



POWER SUPPLY

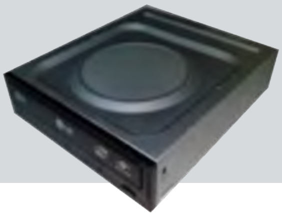
SilverStone Strider E

We may be talking about a budget rig here, but it's still a rather hefty chunk of cash to risk on a no-name power supply. This 500W SilverStone PSU will give you peace of mind and all the PCIe leads you need.

OPTICAL DRIVE

LiteOn IHAS124 DVD+RW

We really wonder whether you actually need an optical drive anymore, but for now we'll err on the side of caution and include one in the list. Don't feel bad if you forget to buy it though.



CHASSIS

Corsair Carbide 200R

Much more impressive than its price tag may lead you to believe, the clean lines and added extras of this chassis make it the budget case to beat. An understated bargain.

SCREEN

AOC E2250SWDNK

This 21.5-inch panel has a native resolution of 1,920 x 1080 and looks pretty good despite that ridiculously-low price tag. It's no IPS-beater, but it'll do for half the cash.

MAINSTREAM

YOU DON'T HAVE TO SPEND A FORTUNE TO GET A STUNNING RIG

MOTHERBOARD
Asus Z97-A

We've seen a lot of Z97 motherboards since this Asus offering was released, but nothing newer has managed to push it off this list. Great features at a great price. Simple really.

CPU COOLER
Enermax ETS-T40

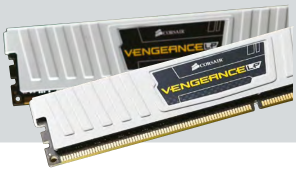
Enermax has simply amazed us with this, its first CPU cooler. The performance is excellent, the price is astonishing, it's easy to fit and it isn't so big that it limits your case or mobo choices.

CPU
Intel Core i5-4690K

For almost the same price as the ol' 4670K you can pick up one of the newer Devil's Canyon CPUs. It's only got a 100MHz clock boost, but the new TIM helps when it comes to overclocking.

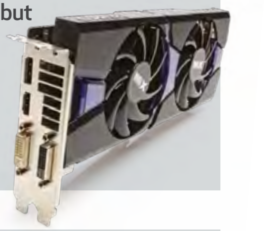
MEMORY
Corsair Vengeance LP 8GB

This pair of 4GB sticks will give you all the performance you could ever want, and they're in stormtrooper white. They'll only take up two slots in the board for upgrading, too.



GRAPHICS CARD
Sapphire R9 285

The newer Tonga Pro GPU in AMD's R9 285 is an impressive wee thing, making it our favourite sub-£200 card right now. The 2GB frame buffer might be a worry for the high-res future, but it's a beauty.



SOLID STATE DRIVE
Crucial MX100 512GB

Crucial has made a big splash in the SSD market with this chunky drive. The 512GB version is quicker, larger and cheaper that the 480GB M550.

POWER SUPPLY
OCZ ModXStream Pro

If you want to build a performance machine, you're going to need a powerful PSU. This 500W baby will power the rig, with extra to spare. It's quiet as well.

KEYBOARD
Corsair Vengeance K65

We love a good mechanical switch keyboard here on PC Format, and Corsair is making some of the best. The K65 is a great compact option, with a compact price to boot.

CHASSIS
Cooler Master CM690

The CM690 eschews silly gimmicks in favour of producing a no-nonsense chassis that has plenty of cooling options for your mainstream rig. There's space aplenty inside, and all at a reasonable price.

SCREEN
Viewsonic VX2370Smh

For years, we've lamented the use of TN panels in gaming monitors, always preferring the delights of the IPS screen. Now one can be yours for just £123.

HIGH-END

IF YOU REALLY WANT TO TREAT YOURSELF, THIS IS HOW TO DO IT

MOTHERBOARD
Asus X99 Deluxe

As usual this Deluxe board from Asus is absolutely stuffed with funky features. It's one of the finest, and best-looking, X99 boards around and not a bad overclocker either.

CPU COOLER
Thermaltake Water 2.0 Ext.

Why settle for a reasonable overclock when you can hit 5GHz? This kit is speedy, boasts incredible performance and is quiet in operation.

MEMORY
Corsair Vengeance 16GB

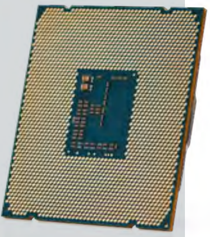
The Haswell-E platform is the first to bring DDR4 to the consumer. That does though come at a hefty price, but it's damned quick...

GRAPHICS CARD
MSI R9 295X2

The dual-GPU R9 295X2 is undeniably the quickest card around. We still worry about these sort of cards, but the liquid-chilling helps those concerns, and it's a beast at 4K.

CPU
Intel Core i7-5960X

If you're after the fastest, most advanced CPU around, then this 8-core, 16-thread Haswell-E is it. There is also the six-core i7 5820K for a more reasonable £300, but the 5960X is the pinnacle of modern CPUs.



SOLID STATE DRIVE
Samsung 840 EVO 1TB

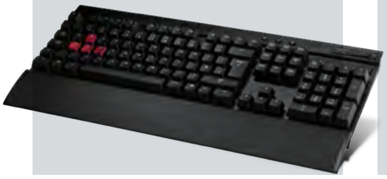
It's been a while coming, but we're finally seeing terabyte-class SSDs at a decent price. The 840 EVO uses some impressive algorithms to offer high speed, too.

POWER SUPPLY
CM Silent Pro Gold 1000W

Cooler Master continues to impress with its power supply units, and this wonderful box of tricks managed to scoop the gold award in our exacting test way back in PCF246.

KEYBOARD
Corsair Vengeance K70

Corsair's update to the older Vengeance keyboard rights all its older sibling's wrongs. It's also a truly stylish gaming board with the red backlight glowing against its black brushed metal chassis.



CHASSIS
CM Cosmos 2 Ultra

Cooler Master has always been an impressive maker of cases, but it has truly stunned us with this chassis. Yes, it's expensive, but if you can afford to drop this much on your case, you'll be more than happy.

SCREEN
HP ZR30W 30-inch

HP's 30-incher is exactly what high-end gaming means to us and if money is no object, this is the screen to buy. You'll need the GTX Titan to really show it off.

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THE NEW KING OF BUDGET COOLING?
SCYTHE MUGEN MAX PUSHED TO EXTREMES
WIDESCREEN SUPERSTAR
AOC U3477PQU FULL REVIEW INSIDE
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Tech Porn

1 Special res
The 3,440 x 1,440 native resolution demands more GPU horsepower than a 2,560 x 1,440 setup, but nowhere near as much as a 4K panel. It also means you get a decent amount of vertical height when you're using the screen simply on the Windows desktop. Previous 21:9 screens suffered from being only 1,080 pixels high.

AOC U3477Pqu

The latest stumbling block for 4K gaming has appeared in the shape of this lovely super-widescreen monitor from AOC. The 34-inch U3477Pqu makes for a far more dramatic addition to your gaming rig than any 4K panel we've checked out so far.

In a static image it's a little tough to get across the difference it can make gaming with the 21:9 aspect ratio compared with the more standard 16:9 we've become used to. The main thing is that, sat at your desk, the panel manages to almost entirely fill your field of vision. We're not talking Oculus Rift levels of gaming immersion here, but the extra width pulls you further into the game than any screen we've used up to now. And AOC has used an impressive IPS panel in the U3477Pqu too. The colours are bright and crisp, and the viewing angles impeccable.

AOC has long been a purveyor of low-cost, budget-oriented monitors, but recently it has begun shipping much higher quality gear. The chassis on the U3477Pqu is no classic, but the bezel is minimal and the no-frills layout has its own aesthetic.

The only issue for 21:9 displays though is one of content. Luckily there are apps around to cater for deficiencies in widescreen gaming, but nearly-all streamed video is still going to give you some black bar headaches to ruin your viewing. ■

Dave James

2 Flawless Widescreen

Because 21:9 monitors are pretty darned niche devices, many devs aren't fitting their games out with support for super-widescreen resolutions. Thankfully the Flawless Widescreen app sorts out most of those problems, check out the tutorial on p90 for more info.

3 Pointless portrait

We've been impressed with the design of the U3477Pqu's chassis, especially given the amount of adjustability in the stand, but do you really need the ability to flip the screen into portrait mode? It could only really be useful on one of those standing desks because you'll struggle to read the top of the panel from a sitting position.

XMAS GIFT GUIDE

TIME TO DISCOVER WHAT CHRISTMAS TREES WERE DESIGNED TO STAND OVER

Christmas gift guides, in our experience at least, tend be full of tat – phone chargers, novelty USB attachments and the kind of rubbish that you wouldn't want to open yourself, let alone give to anyone. Which is why our Christmas gift guide is nothing like that at all. Our gift guide is about quality. It's about picking the best darned components, peripherals and kit to be released in living memory. It's about wanting to rip the box apart and start using it, not adding to the pile of socks and underwear soon to be forgotten.

So if you're looking for a £10 gift for an insignificant other, then we're afraid you're going to be disappointed. However, if you're looking for a real present that someone would love to open, then you've come to the right place. Or if you want to drop a hint to someone that really should treat you, then leaving this feature open for them to happen upon themselves isn't a bad way to go. Feel free to add Post-it notes, or circle the gift you want in red pen.

Over the next few pages we look at the best components in each class of computing and give you our definitive recommendation of where you money should go. This also means that you could take our recommendation from each area and piece together a system that would rock anyone's world. We also cover peripherals, a full system and a laptop, so whatever you're looking for, you should find something that excites you. Happy Christmas from *PCF*!

Object	Item	Price	Page
CPU	Intel Core i7 4790K	£260	54
MOTHERBOARD	Asus Z97-A	£111	54
COOLER	Cooler Master Seidon 240M	£83	54
GRAHICS	Gigabyte GTX 970 G1 Gaming	£299	55
SCREEN	AOC U3477Pqu	£600	55
ACCESSORIES	Nvidia Shield Tablet 16GB	£240	55
CHASSIS	Corsair Graphite 780T	£144	56
SSD	Crucial MX100 512GB	£155	56
MEMORY	G.Skill Ares 8GB 2,133MHz	£73	56
LAPTOP	Chillblast Helix	£1,250	57
JOYSTICK	Thrustmaster HOTAS Warthog	£280	57
HEADSET	Kingston HyperX Cloud	£86	57
DESKTOP PC	Scan 3XS X99 Carbon	£1,838	58
KEYBOARD	Corsair Vengeance K70	£90	58
MOUSE	Shogun Bros Ballista MK.1	£45	58

LGA1150 MOTHERBOARD

ASUS Z97-A

Price £114 **Web** www.asus.com

Asus has built a reputation for itself when it comes to quality motherboards, and with the Z97-A it's easy to see why. The performance is great, the price is pretty much perfect and the feature set is impressive, including SATA Express and M.2 connectors to get the most from your storage.

Your choices aren't limited if you take the multiple-GPU route either, with support for Nvidia SLI and AMD Crossfire. And as this is an Asus board, even the BIOS is up to snuff. Ignore the swathes of far more expensive motherboards and pick up the Z97-A. You won't regret it.

CPU COOLER

COOLER MASTER SEIDON 240M

Price £83
Web www.coolermaster.com

Plenty of folk still see watercooling as too much trouble. We don't agree with that (a custom built watercooling system can eek phenomenal performance from your CPU and graphics setups), but we can see why some are put off by the faff.

There is an easy way to cool your processor with water though, and that's best shown off by the Seidon 240M, which offers up the benefits of a watercooler, but without the hassle. Even mounting it is simple (something that can't be said for every self-contained watercooler). If you want to get the most from your processor, then this is the way to go.

i(M)(C)11
INTEL CONFIDENTIAL
QG81 ES 4.00GHZ
MALAY
L336D081 (e4)

CPU

INTEL CORE I7-4790K

Price £260
Web www.intel.com

Intel has enjoyed a long stay at the top of the CPU charts, and it's easy to see why. The Core i7-4790K clocks in at 4GHz, boosting up to 4.4GHz in Turbo mode, and packs four hyperthreaded cores, along with 8MB of L3 cache. This CPU is home to the DDR3 memory controller and HD Graphics 4600 subsystems too. To get the most out of it (and by that we're talking about overclocking), you'll want a proper watercooling unit, such as the Cooler Master Seidon 240M that you'll find above.

For a smaller budget, the bargainous Pentium G3258 Anniversary Edition is worth considering as an alternative. Frustratingly for AMD it sits in the spot where we'd usually find an FX 6300 chip, but that doesn't stop it being amazing news for you. It helps that the Pentium overclocks like no one's watching, and the fact that it's an LGA 1150 chip means you have an upgrade path to the Core i7-4790K too.

TABLET

NVIDIA SHIELD TABLET 16GB

Price £240 **Web** www.nvidia.com

There are plenty of quality tablets doing the rounds, but until the Shield Tablet came along with its Tegra K10 processor, none of them put gaming front and centre. Anyone looking for the Android tablet for gaming need look no further; there's even a version of *Half-Life 2* available that pushes the Tegra K10 to really show off what's possible.

The Nvidia Shield Tablet goes further than this though, as you can stream from your Nvidia-powered gaming PC to the Shield Tablet and enjoy high-end PC gaming wherever you are. And that includes streaming your PC games to your TV and playing from the comfort of your sofa.

SCREEN

AOC U3477PQU

Price £600 **Web** www.aoc.com

There is so much happening with screen technologies at the moment that it can be easy to lose sight of what's important. 4K, high refresh rates and G-Sync are just some of the technologies that are changing how we view the worlds offered up by our machines.

You won't find any of those in this AOC monitor though. Instead you'll discover a screen that simply makes sense. Games, movies, and indeed your host OS, will never feel the same again due to the ultra-wide aspect of this gorgeous display. Pretty much every game we've played on this screen is transformed into a full cinematic experience. It's what multiple-screen users have enjoyed for ages, but without the bezels mucking up your view. Pricey, but stunning.

GRAPHICS CARD

GIGABYTE GTX 970 GAMING G1

Price £299 **Web** www.gigabyte.com

There's no denying the raw power of Nvidia's top-end GPU, the GTX 980, but it's actually the slightly cut-down GTX 970 that has blown us away this year.

As seen here in its factory overclocked guise, it really does shine in the cost/performance stakes and resolutely sets itself out as the card that defines the rest of the market. In fact, in testing, this overclocked card's performance is so close to the GTX 980 that it barely makes a difference. The GTX 970 boasts 1,664 CUDA cores and lays claim to a healthy 4GB of GDDR5 memory, which means that it's fairly future-proof for tomorrow's demanding games, as well as giving you the best visuals possible in todays titles. This overclocked edition has a base clock of 1,178MHz, boosting to 1,329MHz pretty much constantly. You can overclock it higher than this too, and it never gets loud thanks to the Windforce 3x cooling system.

CASE

CORSAIR GRAPHITE 780T

Price £144
Web www.corsair.com

The Graphite 780T is one of the most aesthetically pleasing towers we've seen in a very long time. It isn't just a chassis defined by its looks though – this case has been designed to fulfil your wildest building dreams. It exudes quality too, and this feeling of luxury isn't limited to its exterior – the ease of access and the design of its interior space put many of its competitors to shame.

The Graphite 780T ships with three 140mm fans (two in the front and one in the rear) to ensure that your core components get plenty of air flowing over them. There's space for more fans as well, whether you need more in the front, in the base or under the roof. It's our new favourite case, and as an added bonus is available in a range of colours – including this gorgeous gold.

RAM

G.SKILLL RES 2X 4GB DDR3 2,133MHZ

Price £66 **Web** www.gskill.com

The thing about memory is that speed doesn't matter any more. Size and price are still considerations, but beyond that, 'enthusiast' kit isn't going to produce returns that are tangible for most normal computer use.

Not even gamers will get much more polygon performance for five times the cost of this bargainous G.Skill pair. They're plenty quick enough (2,133MHz with a CAS latency of nine), roll in at 8GB (which is loads) and even look good thanks to the blue heatspreaders. You really don't need anything more.

SSD

CRUCIAL MX100 512GB

Price £155 **Web** www.crucial.com

Any concept you have about the price of SSDs can be forgotten when it comes to the Crucial MX100 512GB. Not only is it an utter bargain that costs as much as plenty of 256GB SSDs from other manufacturers, but its speed is right up there with far more expensive drives. It certainly doesn't feel like a budget SSD when it comes to performance.

A word of warning though, don't be tricked into thinking that the smaller capacity drives in the range perform equally well. Only this 512GB rendition populates the Marvell 9189's channels enough to offer performance where it matters the most.

LAPTOP

CHILLBLAST HELIX 17" ULTRA SLIM GAMING LAPTOP

Price £1,250 **Web** www.chillblast.com

The critical marriage in any gaming laptop is that of the GPU and the screen. Chillblast has nailed it with the Helix, pairing Nvidia's GTX 870M with a 1,920 x 1,080 16:9 panel.

Other components are important too of course, which is why you'll be delighted to find an Intel Core i7-4710HQ doing the grunt work. There's 8GB of DDR3 to keep things rolling nicely, and a neat combo of a 120GB Samsung 840 mSATA SSD providing speed for the OS and a 1TB Momentus XT Hybrid SSD/HDD drive giving you plenty of space for your games.

This lot all adds up to a system that can play the latest titles without having to scale everything back to keep the framerates smooth. The fact that it looks like a svelte Ultrabook rather than an overcompensating toy is simply the icing on the cake.

HEADSET

KINGSTON HYPERX CLOUD

Price £86 **Web** www.kingston.com

The headset market is incredibly crowded at the moment, and it seems like new cans are released almost daily.

As prices spiral and manufacturers try to compete by offering ever more outlandish features, it's great to see Kingston enter the market and basically focus on the one area where every headset has to deliver – the sound. The Kingston HyperX Cloud is essentially the QPad QH90 in disguise, but with a more tempting price tag, a warmer bottom end and a slightly more comfortable headband and earcups. The detachable microphone may not look like much, but it'll capture your mumbling brilliantly.

But ultimately it's in the audio reproduction that the HyperX Cloud really excels. It's beautiful for movies, gaming or just, you know, enjoying music.

THRUSTMASTER
HOTAS WARTHOG
REPLICA USAF A-10C THROTTLE
U.S. AIR FORCE
THRUSTMASTER
HOTAS WARTHOG
REPLICA USAF A-10C STICK
U.S. AIR FORCE

JOYSTICK

THRUSTMASTER HOTAS WARTHOG

Price £280 **Web** www.thrustmaster.com

There are quite a few big space sims heading to our PCs in the next couple of years (*Elite Dangerous* and *Star Citizen* to name but two), and to get the most out of them you're going to want a decent joystick and throttle set.

This admittedly pricey pair is the current pinnacle for anyone wanting to strut their stuff amongst the stars. Based on the US Air Force A-10C attack aircraft, this replica stick set feels incredible to use, and there enough buttons, switches, sliders and POV hats to create the perfect setup for any game that has you flying around in true 3D. The accompanying software makes setting everything up a breeze as well.

DESKTOP PC

SCAN 3XS X99 CARBON

Price £1,976 **Web** www.scan.co.uk

Here's the thing about computing – it's constantly changing. Evolving. Improving. So how do you stay on top of the latest trends and technologies? You can update your machine as you go or, as our resident curmudgeon Luis Villazon is fond of doing, you can just buy a whole new system every couple of years.

If your machine is beginning to show the strain, then leapfrogging current mainstream technologies and going straight for the high-end isn't bad way to go – and that's exactly what the X99 Carbon represents.

It's built around Intel's brilliant Core i7-5820K (Haswell-E) six-core processor, which has been eased into an Asus X99-S motherboard and with 16GB of DDR4 to call its own, there's no mistaking that this machine means business. Since we first looked at it, Nvidia has released Maxwell, and Scan has responded by updating the X99 Carbon to play host to the current king of performance, the GTX 980. Gaming isn't going to be an issue with this machine. With an excellent warranty too (first year on-site), this all adds up to an incredible system.

MOUSE

SHOGUN BROS BALLISTA MK.1

Price £45
Web www.shogunbros.com

We've seen mice come and go, but none have managed to wrestle the Ballista MK.1 from our sweaty grasp. The subtly-sloped styling makes it incredibly comfortable to use for long periods, and there are enough buttons, LEDs and dpi settings (maxing out at 8,200dpi) to keep us happy. And that's whether we're working, enjoying a spot of sniping, taking Bolton to the top of the Premiership or slapping down Hellscream (or indeed anything else).

Part of the reason we love it so much is the placement of the sensor under your index finger – a subtle difference, but one that just seems to offer a little more control than most centralised sensors. It's a bit of a bargain, too.

KEYBOARD

CORSAIR VENGEANCE K70

Price £90 **Web** www.corsair.com

Mechanical switch keyboards are all the rage, and once you've used one it's easy to see why so many have made the switch (sorry – Ed).

The Vengeance K70 is a fully mech-switched offering, and you can choose the sort of switches you want – standard Cherry MX Red, Brown (less noise) or Blue (audible clicks). Each key is backlit, which lends a stylish glow to its already gorgeous stripped back design. You can rely on your prodding making it to your PC too, with a 1,000Hz polling rate and full keyboard rollover.

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Gaming &

#299 / Christmas

Because gaming is a way of life

"Despite its well-meaning concept, any pressure campaign is going to look bad in the wake of GamerGate"

This month, scaredy cat Dom Reseigh-Lincoln has been facing his fears (and a great big xenomorph) in Creative Assembly's *Alien: Isolation*. With nary a plasma rifle in sight, he's been skulking through the corridors and ventilation shafts of Sevastapol Station, yelping at the sight of scenery that just so happens to resemble a phallus-shaped killing machine.

Let me put on my best Wade Barrett impression – I'm afraid I've got some BAD NEWS! (Look, if you come to this part of the mag, you're gonna get the occasional pro-wrestling reference.) Turns out *Half-Life 3* still isn't a thing. Yes, after years of hopes, dreams and enough whining to tear a hole in reality itself, the continued adventures of Gordon Freeman still elude us. It's a shame for sure, but it isn't *that* big a deal. Valve has hardly been kicking back doing nowt for the last 10 years – launching and supporting the most successful digital delivery platform in the industry is no mean feat. We should probably cut it a bit of slack and, you know, get on with our lives. Hold on... how about a Kickstarter campaign? A Kickstarter campaign designed specifically to pressure to employees into making the next headcrab-related adventure? Guys...?

Yeah, that really is a thing. Two interns at the New Mexico ad firm McKee Wallwork & Company are aiming to raise $150,000 to organise a series of events and marketing drives to convince the developer-cum-publisher to bring *Half-Life the Third* to life. Okay, it's not quite as threatening as it sounds – most of the project revolves around mobile billboards and Gabe Newell lookalikes (seriously), but it's well-meaning desire to show Valve just how much *Half-Life* fans want a sequel couldn't have come at a worse possible time. With the GamerGate debacle and some incredibly disturbing harassment campaigns still fresh in our minds, any kind of collective effort to pressure a member of the industry is bound to come off worse than intended. Seriously, $45,000 for Gabe Newell lookalikes?

In others news, and to no one's great surprise, this year's other *Assassin's Creed* game will be setting sail for the PC. (Yup, there are two *AC*s a year now. Aren't you lucky?) The appearance of a PC version of *Assassin's Creed: Rogue* was already heavily rumoured since its big bro *Unity* has already set sail for these overclocked shores, but frustratingly,it won't make port until 2015.

With the unified release date set in place for Unity, it looked like the days of Ubisoft prioritising the console versions of the *AC* series over the PC iteration were finally over, but *Rogue* proves that we're still second class citizens when it comes to the AAA stab-simulator. Still, at least we get to blow up Man-O-Wars with our souped-up little schooner one more time...

P62
CIVILIZATION: BEYOND EARTH

Want a sequel to your favourite game to be made faster? Try crowdfunding a project to pressure the devs! What could go wrong?

RECOMMENDED

Alien: Isolation
Creative Assembly
PCF298 p64
The game that the Alien series has always deserved. A deep, fun stealth game set in an evocatively realised sci-fi world.
★★★★½

Wildstar
NCSoft
PCF294 p64
Clever questing and a stand-out combat system make for an entertaining MMO that is as large as it is full of character.
★★★★½

Smite
Hi-Rez Studios
PCF293 p66
An addictive game makes the lane-pushing genre more approachable with smart tweaks to the old formula.
★★★★½

Trials Fusion
Ubisoft
PCF293 p70
Fusion's thrill is not found in leaping a yawning chasm, but in the simple clearing of an overhanging ledge with efficient grace.
★★★★½

Diablo III: Reaper of Souls
Blizzard
PCF292 p64
This awesome expansion has made *Diablo III* even better, and includes some fun little goodies. We like.
★★★★½

Titanfall
EA
PCF291 p64
The most exciting multiplayer shooter in recent years, but one that is held back by its questionable staying power.
★★★★½

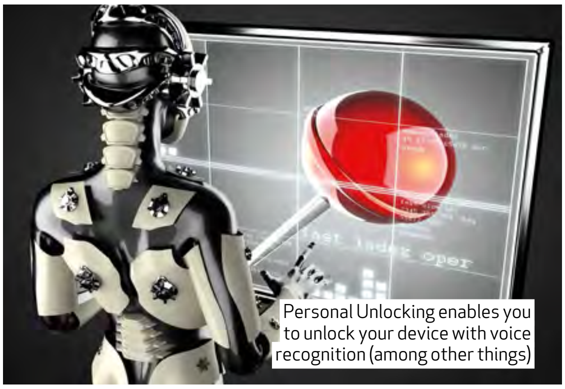
HotWired

IN THE NEWS

Android 5.0 gets a Lollipop

Praise the Sun! A new version of the Android operating system is upon us! Yes, the latest Google-powered mobile OS is a proper, full-fat update (5.0 no less) and is sporting a far less brand-hugging name in the form of Lollipop (sorry, KitKat). Announced earlier in the year at Google's annual I/O developer conference, Lollipop is now out there in the wild and it's sporting a radical new design to go along with its fresh focus on voice recognition as a means of input.

So what's new? Well, Google is shooting what it calls a new 'Material Design', which is essentially a prettier version of the Google Cards system. Think the simple aesthetic prettiness of Windows Phone with the functionality of Android and you won't be far off. Each app now has an 'escalation level' that defines how far it floats above your information panels, and a new 'heads up' notification system that presents a Facebook-style update that overlays any app or game you're using. Google is also touting Project Volta, the new initiative that promises a noticeable uptick in battery life. We're told the amended code will provide up to 90 minutes extra on some Nexus devices, but we'll take that figure with a cruise liner of salt. There are a ton of other changes and new features available with Lollipop too, so head over to our mates at www.techradar.com for more info.



Personal Unlocking enables you to unlock your device with voice recognition (among other things)

BEWARE! INTERNET ADDICTION

The world has its first case of medically certified internet addiction. After more than a few stories where people have died from refusing to look after themselves while playing *World of Warcraft*, it seems spending a little too much time in front of screen is bad for you. Well, knock me down with a feather!

The patient, a 31-year-old US Navy serviceman, was reportedly spending 18 hours a day on the web before he checked himself into rehab. And the source of all this broadband lovage? Google Glass. The serviceman (who has, wisely, chosen to remain anonymous) checked himself into the US Navy's SARP (Substance Abuse Recovery Program) clinic, where scientists are treating his disorder. Welcome to the future, people.

HIGHLIGHTS THIS MONTH

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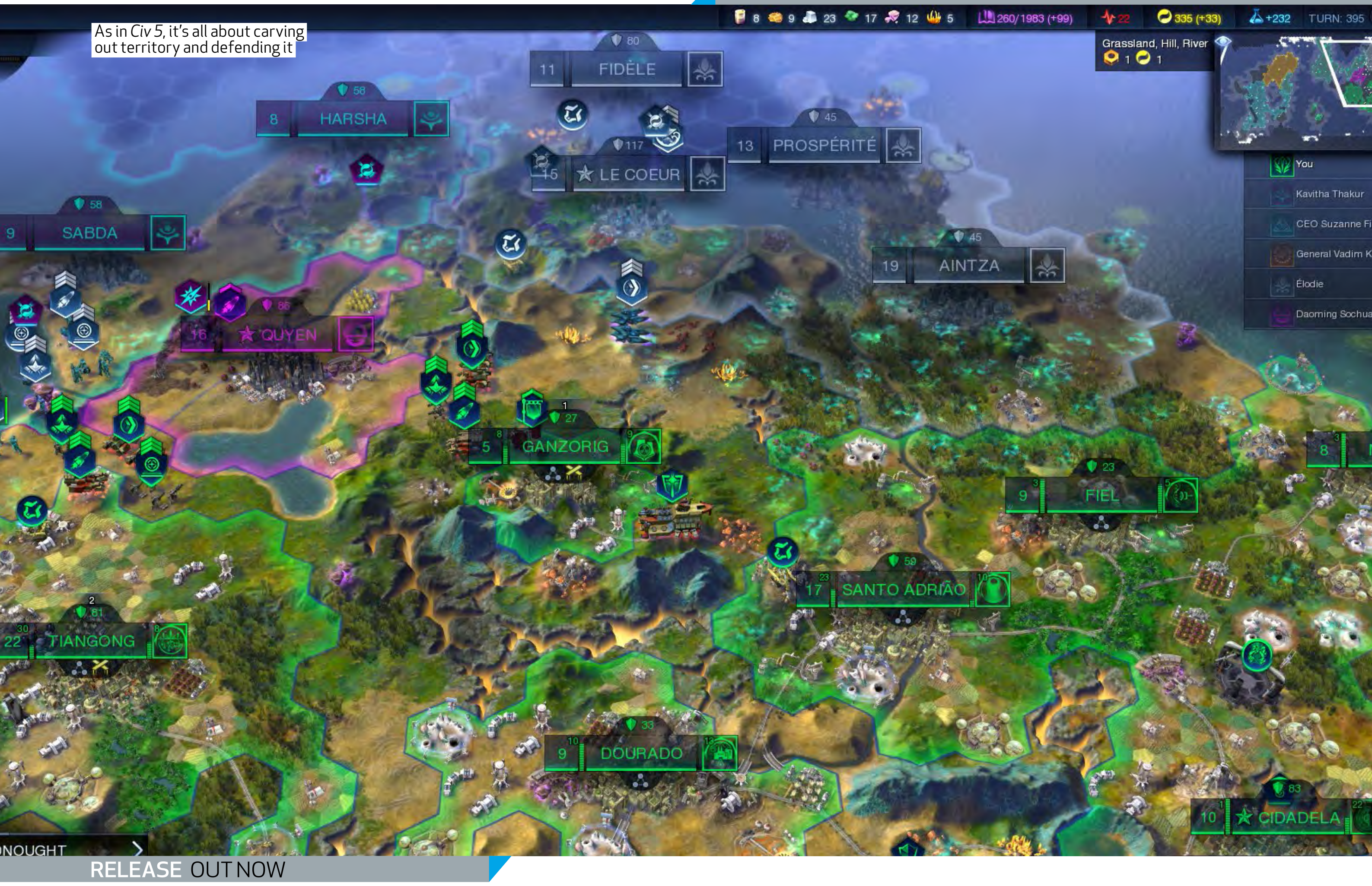
68 The Evil Within

80 Advanced Twitch Streaming

84 Make music with Reaper



As in *Civ 5*, it's all about carving out territory and defending it

RELEASE OUT NOW

Civilization: Beyond Earth

Answering the big question: what next?

B*eyond Earth* begins with the very sci-fi premise of 'what if?' What if you took *Civilization*, the classic turn-based grand strategy game, chose one of its signature endings and turned it into the beginning of a whole new game?

In *Civilization*, you can win by building a spaceship to launch your civilisation into space, in search of a new world. *Beyond Earth* takes that ending and makes it a beginning. You are now on that new world. Go.

The result succeeds in almost exactly the same way as it fails: a major case of cognitive dissonance. Though it bears many attributes of a new game, *Beyond Earth* is based on *Civ 5*'s engine and mechanics. It is in many ways exactly the same game, just spacier.

Is that a problem? That depends on how much you like *Civ 5*, and how willing you are to take the ride and give the new space look a shot.

VITAL STATISTICS

- **Price** £30
- **Developer** Firaxis Games
- **Publisher** 2K
- **Web** www.bit.ly/1wtBA0o
- **Multiplayer** Up to 8 players
- **DRM** Steam
- **Recommended spec** Dual-core CPU, 2GB RAM, ATI HD3650/ Nvidia 8800 GT

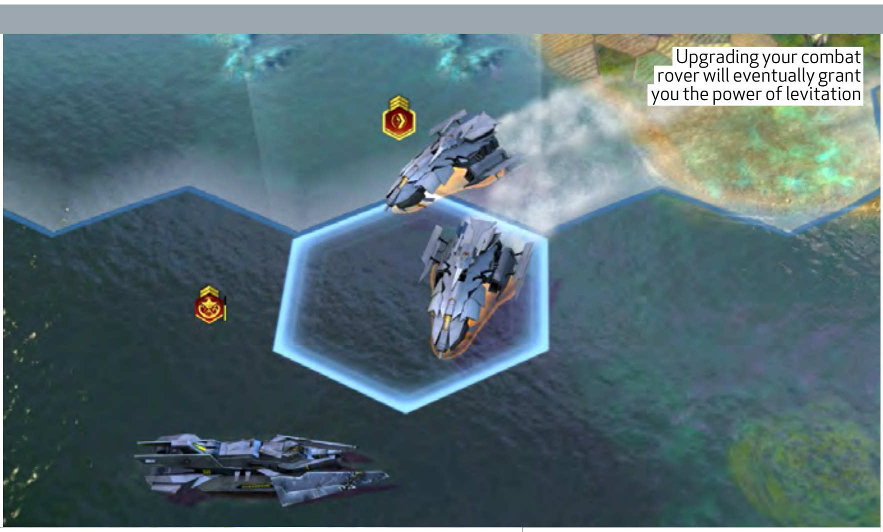
For me it was a problem all through my first game. I played as the Brasilian civ, with its bonus to melee combat. Being a *Civ* veteran, without even realising it I ported over my go-to strategy of focusing on strength in the early age to build the foundation of a strong late-game civilisation. Then I played the game almost on auto-pilot. Perhaps unsurprisingly, I didn't enjoy the experience. It took losing that game and having to step away and reassess how I was approaching *Beyond Earth* to learn how to love it.

One small step

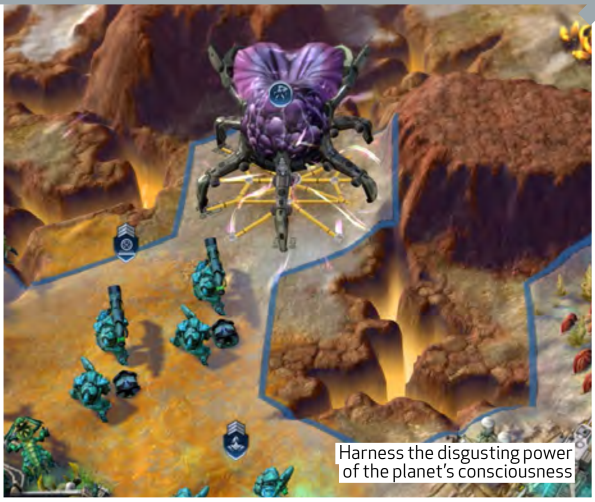
Beyond Earth has a lot of new looks: new units, new victories, a completely new tech tree, new leaders, new civilisations and a handful of things under the hood that are also completely new. But the experience of cracking it open, watching my colony ship settle onto a completely dark map and then setting foot onto this alien world felt just like playing *Civ 5* – at first.

On one hand, there are many worse 4X strategy games to emulate than *Civ 5*, and as that game's expansions have proved, while *Civ 5* redesigned much of the original formula, it left a lot of room on the table for reinventing itself. *Beyond Earth* brings some of the better reinventions along with it. Trade routes feature prominently, as does a new strategic component much like *Gods & Kings*' religions, called affinities.

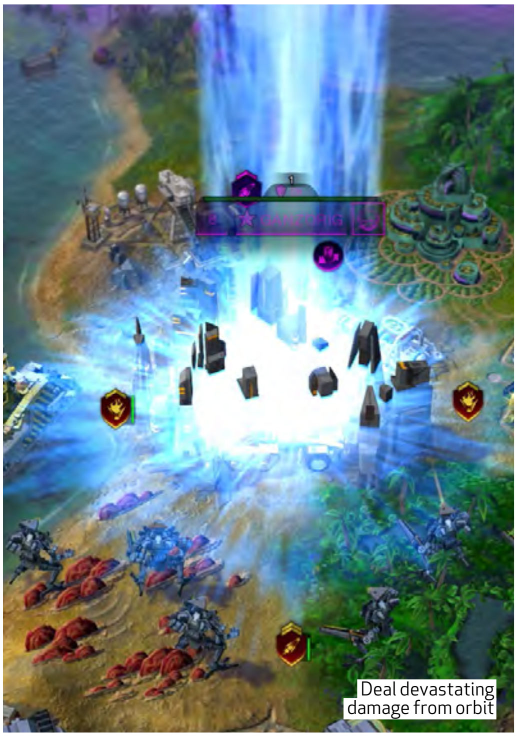
Affinities enable you to focus research into tech that will change the way you interface with your new world. The Harmony affinity enables you to meld with a planet's lifeforms and create new alien units. Purity uses manipulation of the human genome to build better versions of your civ. Supremacy lets you make your civ's humans into cyborgs with giant robot friends.



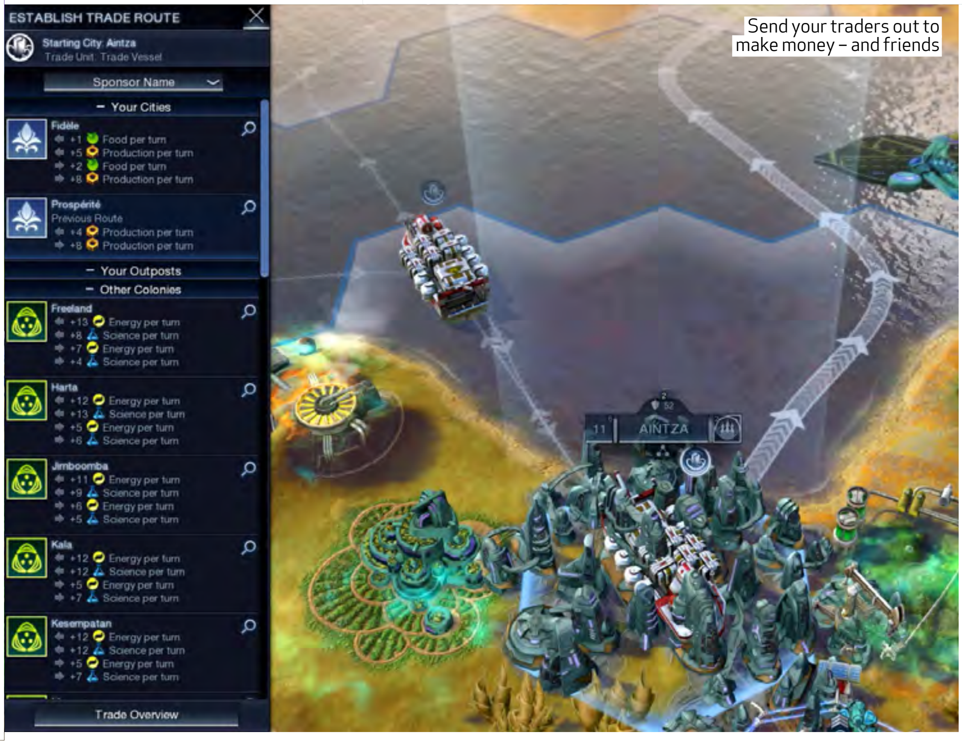
Upgrading your combat rover will eventually grant you the power of levitation



Harness the disgusting power of the planet's consciousness



Deal devastating damage from orbit



Send your traders out to make money – and friends

ESTABLISH TRADE ROUTE

Starting City: Aintza
Trade Unit: Trade Vessel

Sponsor Name

– Your Cities

Fidèle
← +1 Food per turn
← +5 Production per turn
→ +2 Food per turn
→ +8 Production per turn

Prospérité
Previous Route
← +4 Production per turn
→ +8 Production per turn

– Your Outposts

– Other Colonies

Freeland
← +13 Energy per turn
← +8 Science per turn
→ +7 Energy per turn
→ +4 Science per turn

Harta
← +12 Energy per turn
← +13 Science per turn
→ +5 Energy per turn
→ +6 Science per turn

Jimboomba
← +11 Energy per turn
← +9 Science per turn
→ +6 Energy per turn
→ +5 Science per turn

Kala
← +12 Energy per turn
← +12 Science per turn
→ +5 Energy per turn
→ +7 Science per turn

Kesempatan
← +12 Energy per turn
← +12 Science per turn
→ +5 Energy per turn
→ +7 Science per turn

Trade Overview

Each affinity allows for slightly different victories and affinity-only units, and can have a dramatic effect on your game. Specialising in Supremacy will unlock robot soldiers, for example. The Harmony affinity will grant you access to alien-based units and the ability to tolerate the new world's harsh alien environment. Other civs will respond to you (or not) based on your affinity, and your actions in the world can affect your affinity score.

This is most noticeable when dealing with the planet's indigenous creatures. Instead of *Civilization*'s barbarians, *Beyond Earth* has a variety of aliens, some more aggressive than others. At first these seem to be bug-like versions of barbarians, but they play and react differently. Where barbarians will more or less attack whatever is in range, aliens will frequently not attack unless provoked. I was able to send explorer units carefully into heavily alien-infested territories without earning a scratch. At other times, aliens would attack me at random, either provoked by the presence of one of my military units or by the aggressive actions of my civ neighbours. Over-aggressively terraform your new world and your Harmony attributes will be for nought, as aggro aliens force you into conflict. Whereas attempting to clear out the new world's alien lifeforms (instead of attempting to harmonise with them), can lead to them becoming even more aggressive, eventually luring more powerful aliens toward your cities.

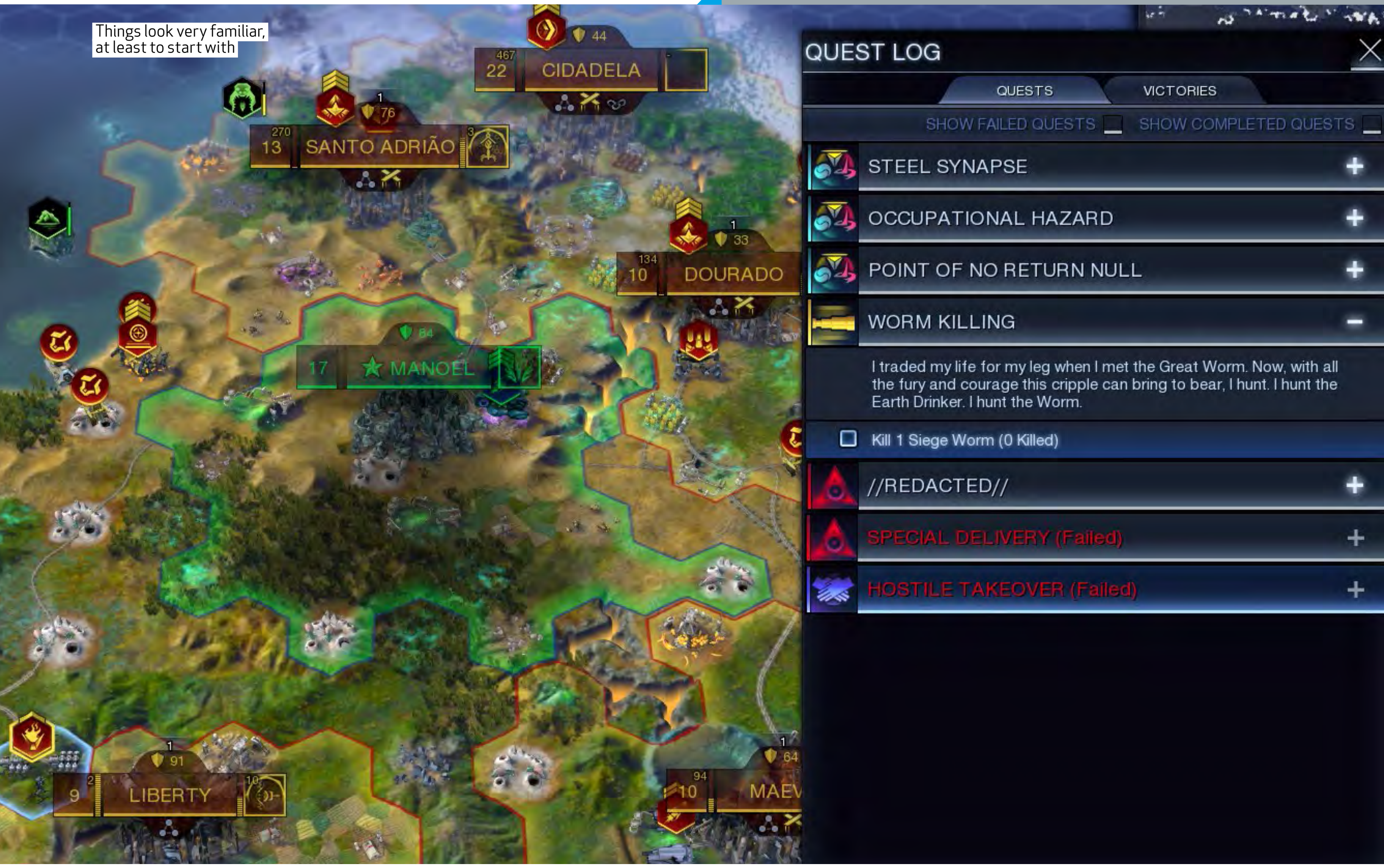
The other big newness is the orbital layer. You can build and launch satellites in *Beyond Earth*, and these will impart benefits to specific tiles. Some are quest- and victory-based, and others are magnificent weapons. The Planet Carver, for example, shoots a beam of weaponised energy from space and it's glorious. You can toggle between the planetary and orbital layer with a button, and you can knock enemy satellites out of orbit with certain ranged units.

The orbital layer adds a fun twist and an engaging tactical element to *Civ 5*'s already finely tuned tactical game. I found myself chuckling at the misfortune of civs that crossed my path when I had Planet Carvers at my disposal. And deploying Solar Collectors and Miasma Repulsers (to clear away the alien planet's harmful, natural vapours) made me feel like I now had a new, more direct tool for improving my cities.

Terra nova

Now for the bad news: it's easy to feel like *Beyond Earth* is just an expansion to *Civ 5*, albeit spacier than others. For *Civ 5* fans like myself, this is a loaded proposition.

If you like *Civ 5*, then more *Civ 5* equals more *Civ 5*, which is great!



Things look very familiar, at least to start with

QUEST LOG

QUESTS VICTORIES

SHOW FAILED QUESTS ☐ SHOW COMPLETED QUESTS ☐

STEEL SYNAPSE +

OCCUPATIONAL HAZARD +

POINT OF NO RETURN NULL +

WORM KILLING −

I traded my life for my leg when I met the Great Worm. Now, with all the fury and courage this cripple can bring to bear, I hunt. I hunt the Earth Drinker. I hunt the Worm.

☐ Kill 1 Siege Worm (0 Killed)

//REDACTED// +

SPECIAL DELIVERY (Failed) +

HOSTILE TAKEOVER (Failed) +

But there's no denying that even as much as I love *Civ 5*, I was expecting something more from *Beyond Earth* than *Civ 5* with a sci-fi skin. And in spite of the opening cinematic, the rocketing descent of my landing craft and the stirring opening text about how my civilisation had travelled the stars to start anew and blah, blah... when that first turn started and my explorer unit stared across the landscape dotted with hex grids and covered in the fog of war, I felt a rush of disappointment.

My new city needed to produce things, and these seemed to be the same old buildings in all but name. And although the alien landscape was littered with seemingly-unusual resources, the deadly 'miasma' and the pods containing goodies from home, all that, too, felt 'same old', at least at first.

So I set about methodically slogging through the familiar in search of the new, and without my even realising it, I found it.

Beyond Earth's many similarities to *Civ 5* mask, to its detriment, a game that is remarkably new and different, and once I was able to see past those similarities, the newness and wonder of playing in a future *Civ* sandbox washed over me. I was engrossed before I realised it.

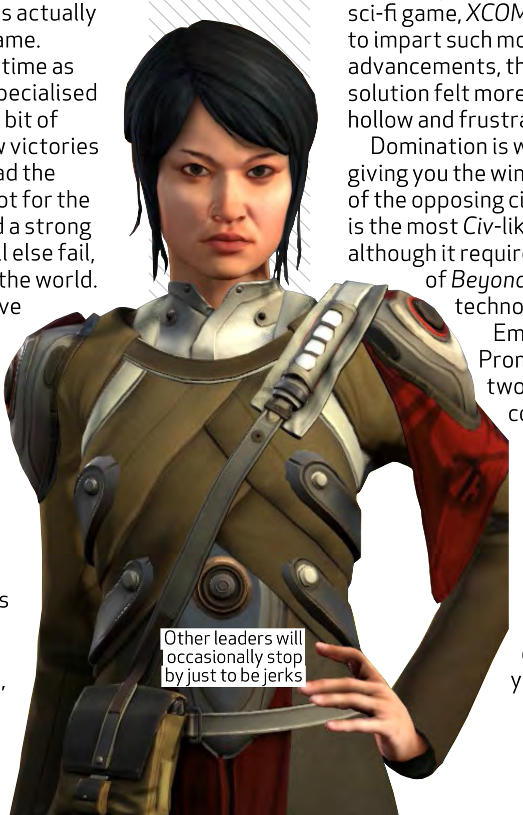
As the Brasilians, I was aiming for a Purity affinity, but fumbled my way through the research web and eventually lost the game without ever realising one of my enemies had been close to victory. Not great, but that's when it finally dawned on me that *Beyond Earth*, in spite of its heavy foundation in *Civ 5*'s mechanics and rules, is actually a completely different game.

So I started again, this time as the Slavic Federation. I specialised in Supremacy and after a bit of research on what the new victories actually were (pro tip: read the manual), I decided to shoot for the Contact victory, but build a strong enough civ that, should all else fail, I could at least take over the world.

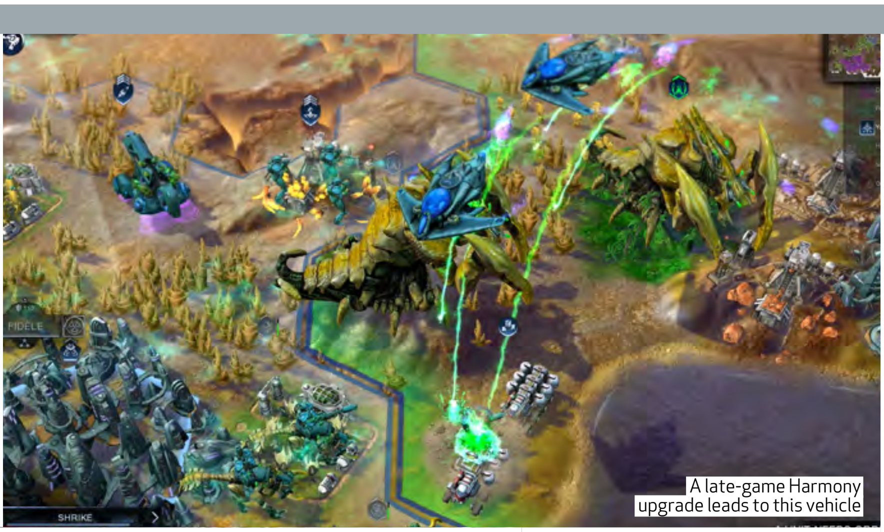
Beyond Earth offers five victory conditions, although two differ only in which affinity will unlock it. Contact involves finding an alien signal and unlocking the secret of your new planet's 'Progenitor' species, an ancient alien race that left mysterious ruins behind. Its attempts at narrative don't always mesh well with *Civ*'s UI. One portion, for example, called for sending a military unit to a newly discovered alien ruin. I located the ruin and dispatched a rover... and waited. And waited. After several turns I finally noticed a new button in the rover's action panel. I pressed the button and the quest concluded with a text box and a ding. Where Firaxis's 'other' sci-fi game, *XCOM*, uses cinematics to impart such momentous advancements, the *Beyond Earth* solution felt more than a little hollow and frustrating.

Domination is what it sounds like, giving you the win if you capture all of the opposing civ's capitals. This is the most *Civ*-like of the victories, although it requires some mastery of *Beyond Earth*'s new technologies and units.

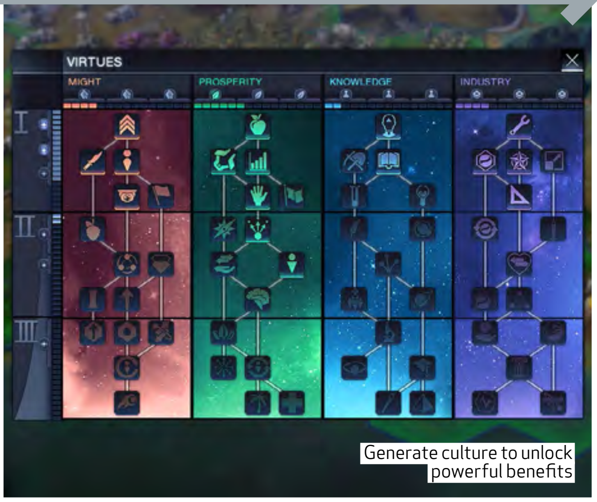
Emancipation and Promised Land are two sides of the same coin. You must research the tech to eventually open either an Emancipation or Exodus gate back to Earth, bringing those left behind either salvation or dominance. If you are Purity or



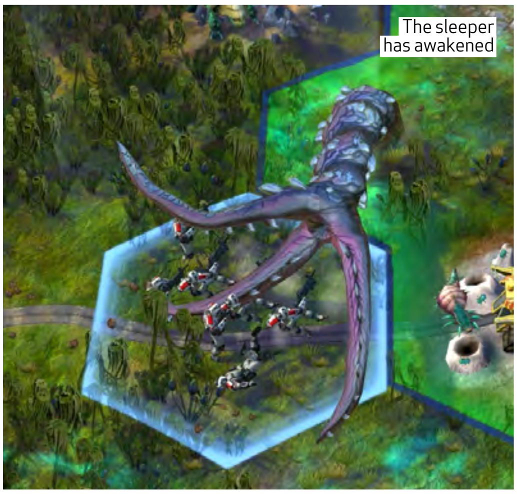
Other leaders will occasionally stop by just to be jerks



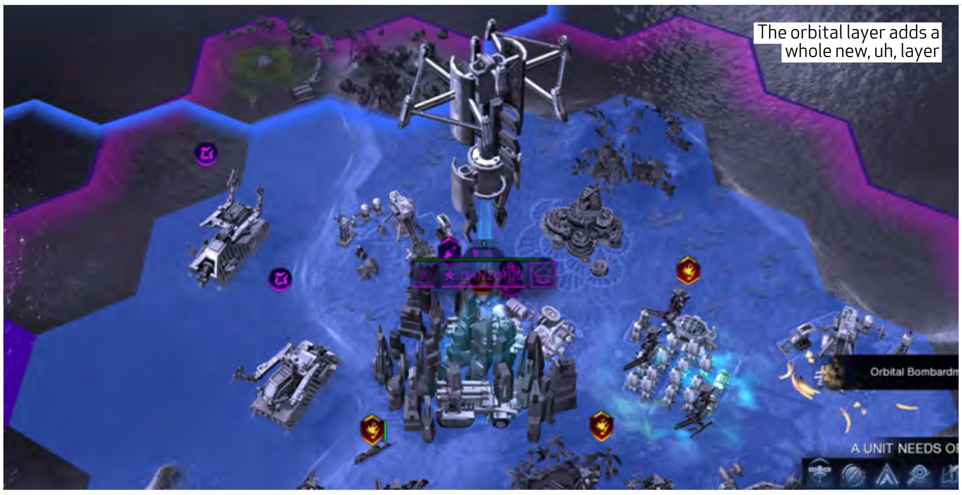
A late-game Harmony upgrade leads to this vehicle



Generate culture to unlock powerful benefits



The sleeper has awakened



The orbital layer adds a whole new, uh, layer

Supremacy, this is your affinity-scientific endgame.

Transcendence is the Harmony victory. It involves researching alien tech to create a 'mind flower' that will unite your consciousness with that of the planet. City buildings can aid in this victory, shortening the time taken for the flower to bloom.

In addition to endgame victories, *Beyond Earth* brings smaller quests. Occasionally these are simply fun things to do. The game has 'siege worms', for example, and a late-game Harmony tech will enable you to control them, like Paul Atreides in *Dune*. But a early-game quest with no affinity restriction simply tasks you with killing one, and if you can pull it off, it's a hoot.

As the Supremacy Slavs, I slaughtered alien lifeforms with abandon, reaping monetary and technological rewards, and tried to focus my research on Supremacy techs to grow my military force. When the ARC civilisation landed on a plain I had planned to colonise myself, I decided to take them out.

What followed was at times a tedious, but overall a successful campaign to take over the ARC land, and clear an alien infestation from a mountainous jungle that would eventually form the production centre of my empire. I first attacked ARC's capital and was repulsed, then withdrew to the jungle to wage war on the aliens, earn upgrades and improve my equipment with scientific research. Dozens of turns later, I emerged from the jungle with a seasoned army and conquered the ARC one city at a time.

As my neighbours inched toward various victories, I invaded their lands to secure my dominance, building a robot empire on the bones of their fallen civilisations.

Childhood's end

After that, I picked the Franco-Iberian civ and focused on the Harmony affinity. Instead of clearing the alien miasma, I left it alone and eventually developed immunity through technology.

Focusing on trade and science, I built a civ that spanned two large islands on an archipelagic planet. I traded with every other civ, giving us all a boost in income and science. I made deals for resources. I made friends. Meanwhile I used my trade vessels to boost my productivity and growth, and built city and tile improvements for a scientific edge.

When war broke out between the Polystralians and the PAC, I took no sides. When the Brasilians edged closer to their own Transcendence victory, I made trade routes to beef up my science and closed the gap.

When I pulled ahead, and Brasilia began massing troops at my border, I formed alliances elsewhere and poured money into my military.

Ultimately, war never came. Although I was forced to kill a handful of aggressive aliens, I managed to dominate my fellow civs with the classic combo of science and trade. And when my mind flower bloomed, I felt like I finally understood everything *Beyond Earth* had to offer.

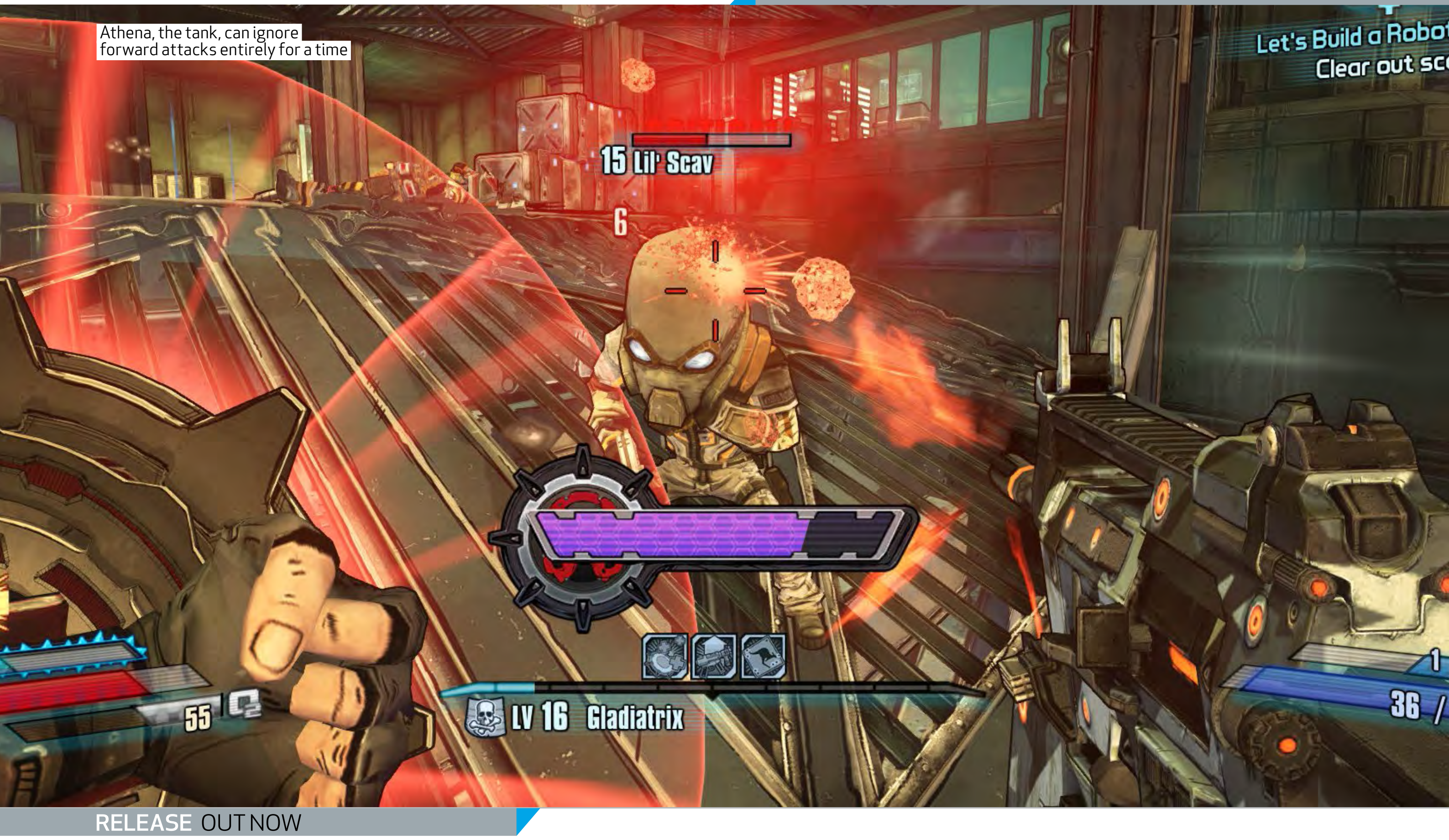
This is how *Beyond Earth* succeeds. It offers a game steeped in the traditions of the series, that's nevertheless new in often unexpected ways. In *Beyond Earth*, victory feels like living in – and forging – humanity's future, and I can honestly say I've never had more fun building a civ "to stand the test of time." ■

Russ Pitts

PCFormat Verdict

Its foundation in *Civ 5* makes it familiar, but this is a game full of surprises that are pleasantly difficult to master.

★★★★½


Athena, the tank, can ignore forward attacks entirely for a time

RELEASE OUT NOW

Borderlands: The Pre-Sequel

It's a bullet ballet in low gravity, but one that's gasping for new ideas

Fifteen hours in, I realise I'm playing *Borderlands: The Pre-Sequel* as a flying Ghostbuster Captain America. My character class, Gladiator, grips a round shield in her left hand when her class ability is triggered, absorbing or reflecting damage before hurling the shield like a boomerang-frisbee. In her right is my favourite weapon, Miss Moxxi's Vibra-Pulse, a laser that spits a wavy line of volts like Egon's proton pack. As I'm electrocuting and shield-tossing, I'm floating through the air, kept aloft by the low gravity of Elpis, the game's lunar landscape.

Borderlands is best when its irreverence is reflected in its combat, when it's layering the insanity of its characters atop weird weapons and enemies. Near-weightlessness is a terrific tweak to that formula; launching rockets at vulgar mutants and mechs is just more playful when you (and your co-op teammates) are lilting softly through the air.

I bounded my way through most of the game. Tapping the jump button while airborne spends a single mid-air boost from your Oz kit (a new item that takes the place of relics), and hitting [Ctrl] sinks your character down to the surface.

VITAL STATISTICS

- **Price** £40
- **Developer** 2K Australia, Gearbox Software
- **Publisher** 2K Games
- **Web** www.borderlandsthegame.com
- **Multiplayer** 4-player co-op
- **DRM** Steam
- **Recommended spec** Dual-core CPU, 2GB RAM, GeForce 9800GT/ Radeon 4870

A new vehicle, the Stingray, mirrors your movement abilities as a player. It's an agile hovercar with good lateral movement, but more importantly you need its vertical boost ability to pop over certain crevices. You can also slam back to Earth as an attack. Shattering enemy buggies and squashing footsoldiers this way is terrific.

The changes to movement bring novelty and a weird gracefulness to Borderlands' combat. But otherwise, *The Pre-Sequel* feels like a super-sized mound of *Borderlands 2* DLC. The new setting, classes and weapon types reinvigorate things a bit, but it doesn't deviate much from the feel and format of the last game. It's fun, but very familiar.

Rayguns and railguns

I finished *The Pre-Sequel* wanting more mission variety – especially ones that made creative use of the new movement mechanics. Almost every mission followed the same structure: go to a location, press the 'Use' key on a computer console or character, and shoot some enemies along the way. Even quests that are thematically different, like delivering flowers to suitors for Nurse Nina, or exploring ice caves to place a mining drill, feel like equivalent errands punctuated by similar firefights. *The Pre-Sequel* would have benefited from a large-scale combat sequence or maybe an escort-sniping mission.

The problem with mechanically simple missions is that their fun relies entirely on funny dialogue and interesting firefights, both of which are inconsistent throughout *The Pre-Sequel*. Combat can be great – one of the first bosses pounces and floats between a bunch of indoor platforms, some of which are electrified. Chasing him without shocking yourself and fending off his minions was frantic and tough.

The Pre-Sequel ends on a high point too. The last chapter

Welcome, new citizen! Obey my commands.

Man, Princess Leia is really bossy

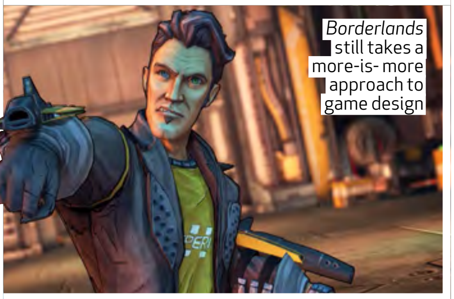
Red, Then Dead
Find path into saferoom:
Kill third Lost Legion courier:
Pick up ECHO messages: 2 / 3
23 Lost Legion COC Suit
x26

The wavy beam weapons are fun to control

Go to observation area
Retrieve scientist
18 Spring Stalker
CRITICAL!

Wearables sure have gotten out of control in the future

It's really unclear when you've scored a crit



Borderlands still takes a more-is- more approach to game design

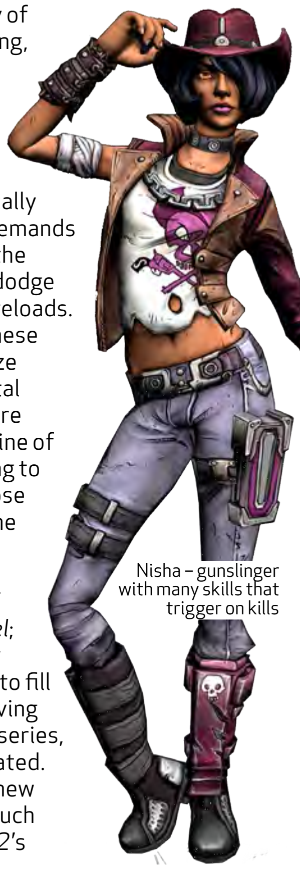
mercilessly throws a variety of jumping, somersaulting, flying, cloaked, ranged, and melee aliens and soldiers at you, alongside enemies that enter a cocoon state and level up if you don't kill them quickly enough. It's a terrifically exhausting sequence that demands careful use of abilities, and the mid-air dash manoeuvre to dodge and reposition yourself for reloads.

New guns help mitigate these threats. Cryo weapons freeze enemies when their elemental effect triggers. Better yet are the new lasers: wrangling a line of energy in mid-air is like trying to spray someone with a firehose after leaping off a trampoline

That's no moon

Broadly, that's the extent of what's new in *The Pre-Sequel*; there aren't many other new weapon types or attributes to fill out the armoury further. Having spent a 100+ hours with the series, everything else feels templated.

Likewise, I didn't find the new enemies to have nearly as much personality as *Borderlands 2*'s half-clothed, charmingly crude bandits. Mechanically they're interesting enough: tracking jetpackers while you yourself are airborne is a fun challenge, and engineer enemies throw up bubble shields that force you to engage at close range. But so many of the baddies that you find yourself blasting after halfway point are straightforward space marines, who don't provide the same vulgar quips and last words that I loved hearing from *BL2*'s scavs. The late-game aliens are in the same boat, never uttering a word as you fight them. They aren't boring to fight, but their seriousness doesn't match the otherwise silly tone of the game.



Nisha – gunslinger with many skills that trigger on kills

I do love the way that 2K Australia pokes some irreverent fun at its homeland, though. The best dialogue in the game comes from the inappropriately cheerful citizens of Elpis, who casually shrug off the moon's many dangers and drop exaggerated Australian slang.

Loot-wise, a new station, The Grinder, gives you something to do with unwanted rare guns. Three weapons of the same rarity can be loaded in and destroyed to spit out a weapon of higher rarity. When operating the machine, you have the option to spend moonstone, the resource used to upgrade ammo capacity, to have a chance to create a 'luneshine' weapon, which adds a random special attribute such as restoring oxygen to your Oz kit when you damage enemies.

The Pre-Sequel is a happy to be just another *Borderlands* game. I enjoyed it, but I also finished it thinking my time would have been better spent on one of this year's more original games. I love seeing *Borderlands* embrace the trend of unconventional movement. Apart from the low-gravity leaping, though, it doesn't do much to freshen what we've been playing since 2012. ■

Evan Lahti

PCFormat Verdict

A well-executed but unambitious extension of *Borderlands 2*. The low-gravity setting helps a bit, but it's short of a must-buy.

★★★★☆

Zombies on stilts are the worse

RELEASE OUT NOW

The Evil Within

Replacing fear with ridiculous amounts of gore and some questionable design choices

Halfway through *The Evil Within*, I came across five abandoned wheelchairs in a darkened hospital hallway. To me, this summed up the game's philosophy perfectly. One wheelchair in a hallway would be spooky, but five? That must be five times as spooky, right?

Forget about a blood trail the floor or a handprint on a wall – here comes a river of blood that pulls you down a chute of blood and deposits you in a chest-high pool of blood.

Unfortunately, a hundred times the gore doesn't produce a hundred times the scares. *The Evil Within* is challenging, tense at times, and often exciting, but in place of terror there's just a ton of grisly gross-outs. If you're looking for horror, you'll find it the many design flaws.

We start by meeting protagonist Sebastian Castellanos and his fellow detectives. Are you done meeting them? Good, because after a few brief words they're whisked off to a hospital where they stand gazing at mutilated bodies. There's no tension-filled foreshadowing: you just walk through a door and wind up standing knee-deep in it. Within minutes, Sebastian goes from hanging upside-down in a human slaughterhouse to creeping through gore-splattered hallways while a chainsaw-wielding maniac hunts him. A few minutes more, and the ridiculously named town of Krimson City is twisting in on itself like a giant Rubik's Cube, and the detective is on his own, in the dark, surrounded by abominations and with little to fight them off with.

VITAL STATISTICS

- **Price** £35
- **Developer** Tango Gameworks
- **Publisher** Bethesda Softworks
- **Web** www.theevilwithin.com
- **Multiplayer** Singleplayer
- **DRM** Steam
- **Recommended spec** 64-bit Windows 7/8, i7 4+ cores, 4GB RAM, GeForce GTX 670

Head games

Initially, Sebastian's only chance is to employ stealth. Although he has a revolver, there's precious little ammo to be found, and shooting his shambling foes, even in the head, rarely puts them down for good.

Careful creeping, hiding, and liberal use of the knife is required, along with setting fire to bodies to ensure they don't get up again.

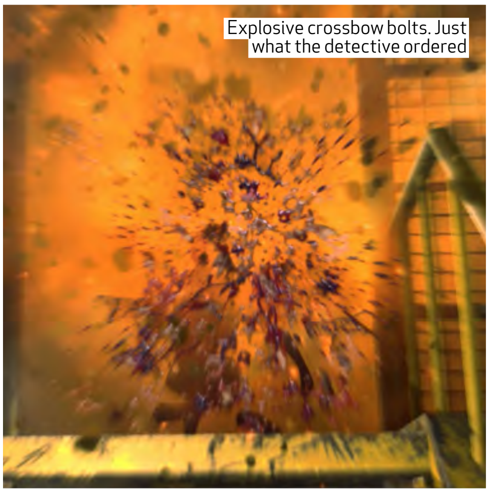
Later, a shotgun and sniper rifle are introduced, and most importantly, a crossbow, for which Sebastian can fashion various bolts by disarming mechanical traps. While stealth remains important throughout, later on the game goes for flat-out gun-blazing action.

While I didn't find *The Evil Within* scary, I did at times find it tense and exciting. There are areas so dark that even Sebastian's charmingly silly old-timey lantern barely illuminates the gloom, and even knowing full well what you'll find (monsters and traps) it's impossible not to be nervous while exploring.

This is also a very challenging game that has no interest in making things easy for you. One sequence throws everything in the book at you at once: I had to manage my

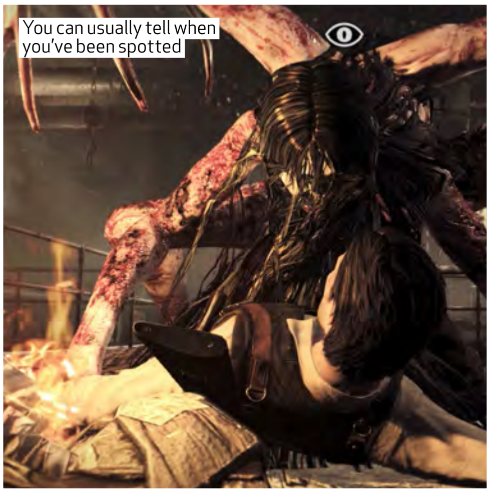
Put your hands up! All four of them. Please

Dude, guns are my thing. Stick with biting



Explosive crossbow bolts. Just what the detective ordered

Hide and seek has changed since I was a kid



You can usually tell when you've been spotted

sprint meter, have perfect aim, search the floor for traps and scan the ceiling for triggers, all while killing loads of lesser zombies and being pursued by an essentially unkillable boss.

Difficulty by design

While intentionally making things tough is fine, making them more so through restrictive presentation and rotten controls is not. *The Evil Within* forces an aspect ratio of 2.5:1, meaning about 30 per cent of the screen at the top and bottom is covered by black bars. This makes the awkward follow camera, which is already often stuck directly behind Sebastian's head or body (or butt, when he's crouching), even worse than it already is.

Bethesda hurriedly released a set of console commands enabling fullscreen, but it's accomplished by zooming in, so Sebastian's body takes up even more space.

Either way, the presentation sucks, and The game doesn't look great anyway: while some of the environments are nicely detailed, the characters look like they'd be at home on the last generation of consoles, and late texture pop-ins were common and distracting during cutscenes. The framerate is capped at 30fps, and while that felt fine to me, when I played with it unlocked it looked a bit smoother.

Controlling the detective is a sluggish experience. With the dozens of wheels, valves, and levers he has to activate, getting him close enough and facing the right way is often tricky. Furthermore, XP is represented as green goo, which must be collected from jars or scooped up from the bodies of dead enemies. Want to watch Sebastian perform his 'pick up' animation one million times? I sure hope so.

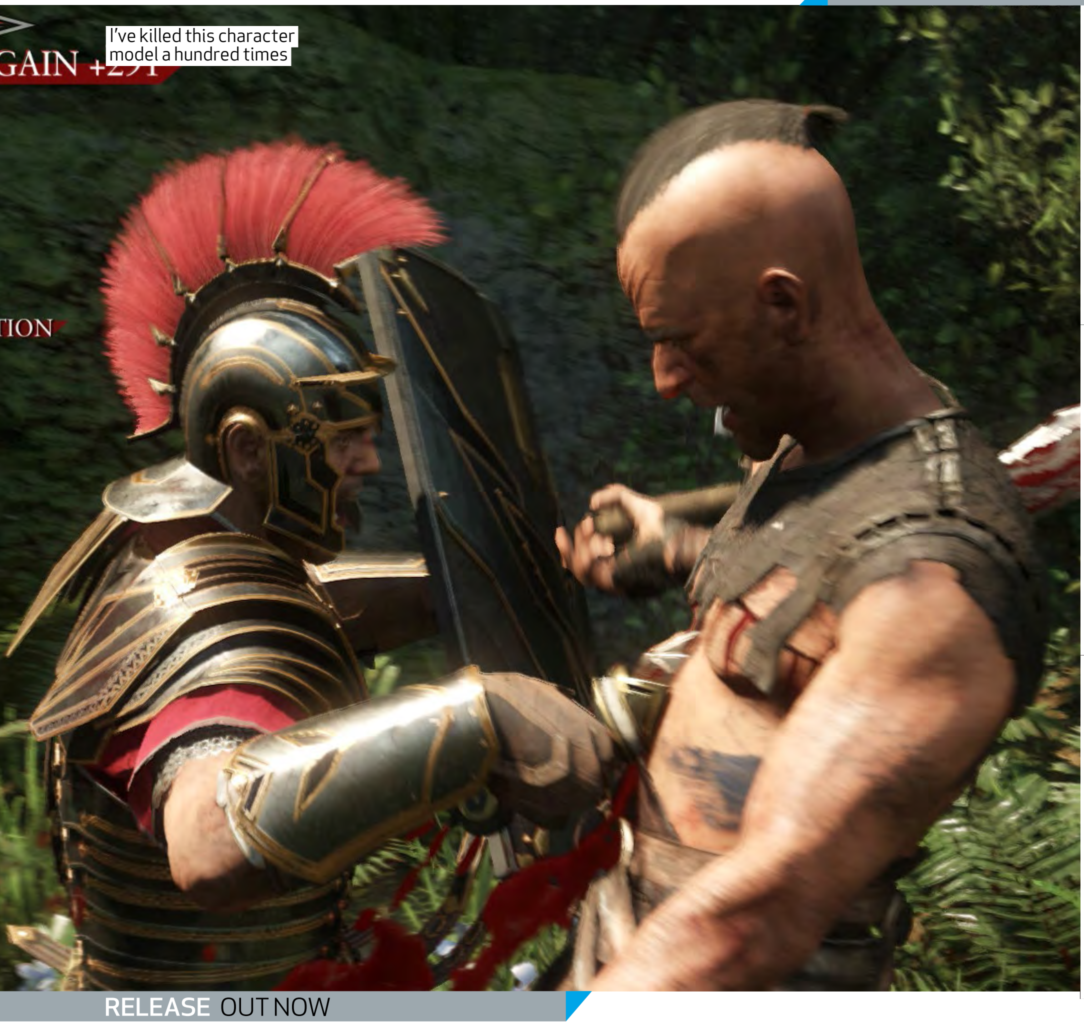
The story can be slowly pieced together through journal pages and recordings found in the usual places, but there's nothing very satisfying to the explanation of why Monsters Are Happening.

I know that fans of director Shinji Mikami's past work won't want to miss this, but despite some exciting action sequences and enjoyable fights, and a hardcore old-school survival challenge, I'd have a tough time recommending it. The controls are sluggish, the video options limited, and the aspect ratio decision utterly stupid. All of this drags *The Evil Within* from enjoyably challenging to needlessly frustrating. ■ **Chris Livingston**

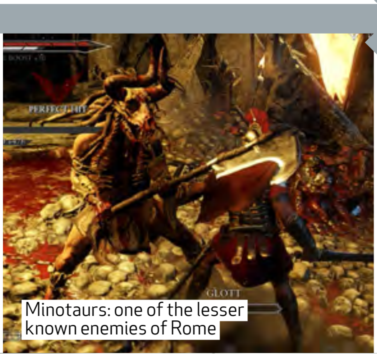
PCFormat Verdict

A challenging blend of stealth and action, but it relies on gross-out rather than fear, and is plagued by poor design choices.

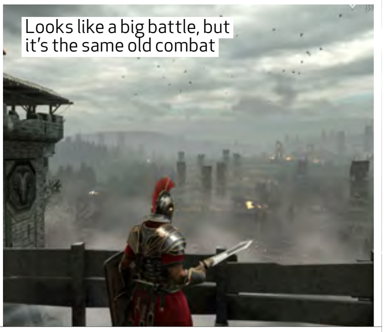
★★★☆☆



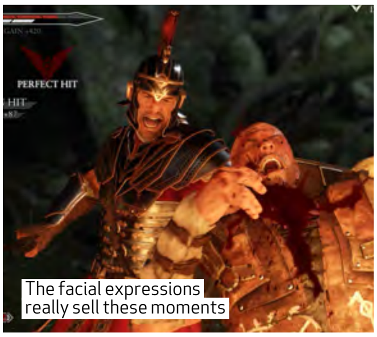
I've killed this character model a hundred times



Minotaurs: one of the lesser known enemies of Rome



Looks like a big battle, but it's the same old combat



The facial expressions really sell these moments

RELEASE OUT NOW

Ryse: Son of Rome

A stunning third-person sword-fest, but it can't get by on looks alone

Marius, a Roman legionnaire with a neck as thick as a glazed ham, is on a mission to avenge multiple murdered father figures. He finds Rome beset by the most ferocious barbarians the world has ever known: British people.

A group of them corner me in a courtyard, but they're no match for my ability with a gladius and scutum. With slashes, bashes and dodges, I weaken them until execution markers appear above their heads, at which point I kill them, relieving them of a limb or two in the process. It's all about timing and matching the right attack to the right enemy, who's always conveniently glowing the colour of the corresponding button.

It's essentially the combat from the *Batman* and *Assassin's Creed* games, which I like, but what makes those games so much better is that they start with those core mechanics, but add new gadgets, enemies, and other wrinkles. They have open worlds where I could use that combat to accomplish a bigger goal. *Ryse* has none of that.

From that first encounter to the last, nothing changes. There were brief sections where I led troops in a straight line, and turret sections straight out of *Call of Duty* (only with a ballista), but *Ryse* is almost entirely third-person combat.

Watching the executions over and over did give me time to appreciate them. It's not just the body animations that are realistic, but the facial expressions too. Marius frowns, winces, and grunts at the right times. The barbarian's jaw goes slack, and his eyes widen in shock and curiosity at the sword that just emerged from his chest.

But for all its beauty, *Ryse* is incredibly narrow. It took me to ancient Rome, the wilderness of York, and a cliffside outpost battered by waves, but somehow I was always on a path barely wider than Marius, and with him taking about a third of the screen most of the time, it feels claustrophobic. It's like looking at the most beautiful game ever made through a keyhole.

I'm also annoyed that *Ryse* is more inspired by *God of War* than real history. This is ancient Rome. There's no need for impossibly intricate armour, transforming coliseums, and a story that dips into the supernatural. It's meant to create the sense of a vast, epic tale, but it just makes the limitations more obvious. ■ **Emanuel Maiberg**

VITAL STATISTICS

- **Price** £35
- **Developer** In-house
- **Publisher** Crytek
- **Web** www.crytek.com/games/ryse
- **Multiplayer** Two player coop
- **DRM** Steam
- **Recommended spec** Quad Core CPU, 8GB RAM, DX 11 2GB graphics card

PCFormat Verdict

The combat and incredible graphics are entertaining, but it's too narrow and repetitive, even for a short game.

★★★☆☆

T3
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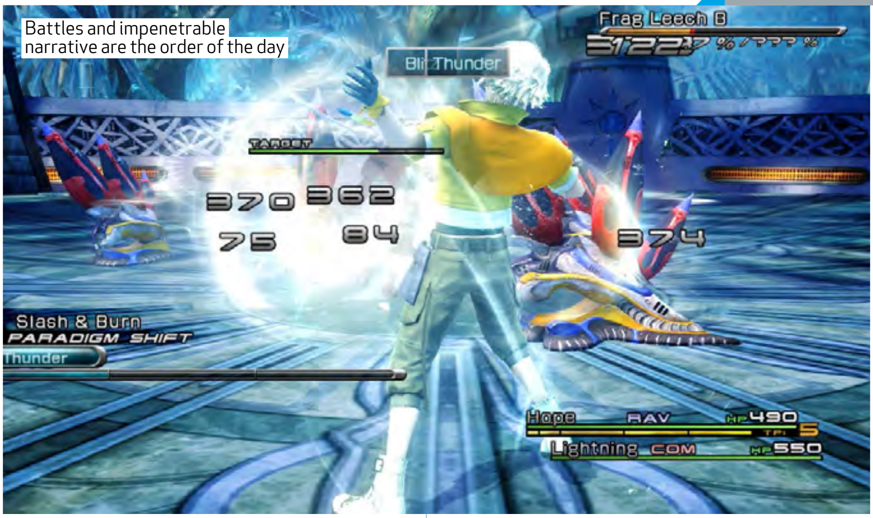
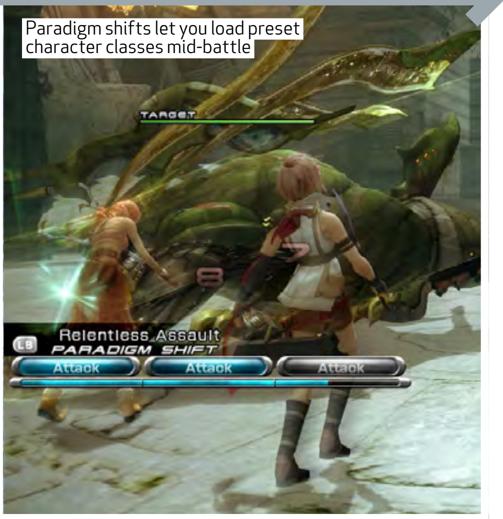


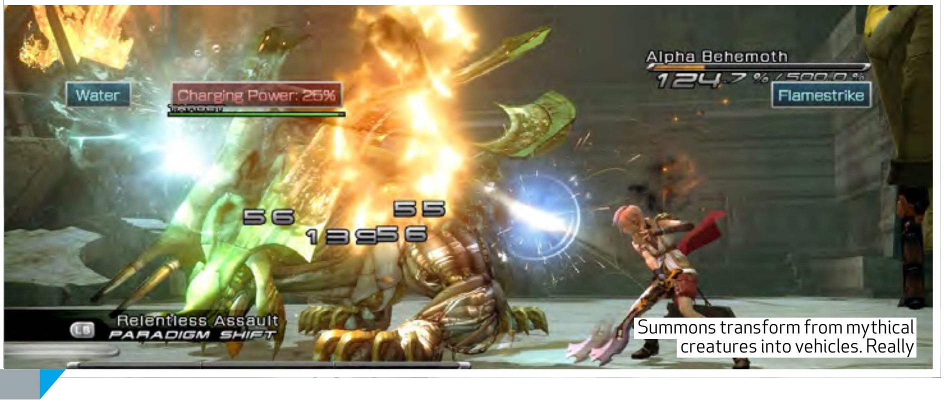
Battles and impenetrable narrative are the order of the day



Paradigm shifts let you load preset character classes mid-battle

Cleanup?
Let me help!

Hope you brought a bloody sponge, mate



Summons transform from mythical creatures into vehicles. Really

RELEASE OUT NOW

Final Fantasy XIII

A problematic port of a flawed RPG

Taking place in a mostly linear world that straddles sci-fi and fantasy, *FFXIII* is primarily about turn-based, real-time battles and delivering a giant, baffling narrative.

The first 20 hours of the game are like a long tutorial, just walking in a straight line between battles and cutscenes. The story, set in the two warring states of sci-fi city Cocoon and the wildlands of Gran Pulse, follows an irritating group of characters cursed by gods known as the L'Cie into fulfilling their destiny – which I think, feeling my way through the impenetrable terminology, is saving the world.

The core group of characters is led by the much-despised Lightning, who I actually like, since she's a functionally identical protagonist to *FFVII*'s Cloud and *FFVIII*'s Squall in being a grumpy, spiky-haired warrior with a cool yet impractical sword. Your six-character party and the extended cast is mostly made up of people I wouldn't cross the road to save, and with so many cutscenes in the game you'll have plentiful opportunities to build up a seething resentment towards them and their lovely hair.

With only this noisy but sometimes enjoyably melodramatic narrative and a stream of samey battles to occupy players until it finally opens up, *Final Fantasy XIII* is undeniably a nightmare for most people to get into. Eventually, you reach Gran Pulse, a lovely open environment with impressive giant-sized enemies and even some sidequests – just more battles, really, in the form of bounties.

VITAL STATISTICS

Price £11
Developer Square Enix
Publisher In-house
Web www.finalfantasyxiiigame.com
Multiplayer None
DRM Steam
Recommended spec AMD FX-6200 CPU, 16GB RAM, AMD Radeon HD 7870

Slow starter

Generally speaking, I love *Final Fantasy*, but *XIII* is hard to defend. It has one of the series' best combat systems, a quick-paced affair that relies on reconfiguring characters' strategy on the fly, but I could not reasonably ask you to wait 20 hours until that becomes clear. Your time on this Earth is simply too short.

Final Fantasy XIII has forgotten it's on PC, too. When I hit the menu to change resolutions from the automated 720p to 1080p, there is no way to do so. When I want to fiddle with the anti-aliasing to sort out the crosshatching hair effects, I can't. *Final Fantasy XIII* has no graphics settings, locking itself at 720p. In the field – and by 'field', I mean a shiny corridor with three guys in it – *FFXIII* can even drop below 20fps on my mid-range AMD card. It's not an unplayable port, but it's very far off the ideal.

This is a weak version of an already contentious RPG, then. Players that find themselves won over by the combat system of *Final Fantasy XIII* and are patient enough to deal with the structural problems will eventually be rewarded for sticking around, but it never lives up to the still superior journeys of *VII* and *VIII*. ■ **Samuel Roberts**

PCFormat Verdict

Parts of *Final Fantasy XIII* are worth the absurd amount of time it takes to properly open up, but this port is a big letdown.

★★½☆☆

Future

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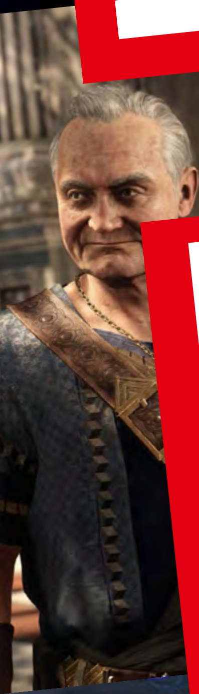
Designers create whole galaxies, and introduce players to the rules that govern them

A DESIGN FOR LIFE

HOW GAME DESIGNERS ARE SHAPING ENTIRE WORLDS FOR US TO PLAY WITH



There is a certain theological argument that the entire point of mankind's existence and evolution is to become gods. Every step in our development as a species, from the emergence of life from the primordial soup, to the first time our fishy ancestors stood on terra firma, to a man in an ape suit throwing a KFC chicken drumstick at Stanley Kubrick, has been towards becoming deities. It makes sense: what better way to ensure our survival than to become omnipotent and immortal?

But there are gods are already moving among us. You won't find them in magic neverending sky palaces or the Great Pyramid of Giza. Instead they're more likely to be slurping coffee by the gallon in the swanky studios of a games company. These are the closest things we have to divine beings walking among us.

It's fairly obvious that these people are playing god by controlling and scripting the AI entities which inhabit a game's world. They shape the landscape, arrange the flora, set the weather and map routes. They build lands and breed their inhabitants; they control everything from the design of an abode's wallpaper to the shape of entire planets.

But this isn't anything new: artists and writers have been creating fictional places for millennia. There's another layer of activity happening here – one that's more profound and more philosophical. Game designers are actively engaging with and changing the way that gamers – people like you and me – think, act and react. They're telling us which path we should take, or who to kill and who to save, using sometimes incredibly subtle psychological cues to make us feel fear, or comfort, or anger. And they're putting in a huge amount of hard work to take us to utopias and dystopias.

Over the next four pages, we chat to some of the most important names in game development to tell the story of game design, and to get to grips with the intricate ideas, theories and perspectives that explain how interactive entertainment is built.

Galloway cites the *Half-Life* series as the best ever

Want to study games? Go to Dundee's Abertay University

If a wing is knocked out in *Star Citizen* you'll have to divert power

> "Game designers are changing the way gamers think, act and react"

Game studies

Want to design games? Dayna Galloway explains Abertay University's various course options

Game design is an enormous and broad subject that takes in many different academic disciplines: mathematics, physics, film and media studies, architecture, art and design, and sound engineering all play parts in the development of games. So how is it taught?

"At Abertay University we have the fortune to be able to teach game design within the broader context of games development, whereby our game design students have the opportunity to work alongside students studying for a degree in one of the other disciplines (programming, art, production and sound)," explains programme tutor Dayna Galloway. "Our approach to teaching is a careful balance of theory and practice – we aim to ensure that our graduates can meet the demands of the industry today, but also that they possess the skills, confidence and knowledge to drive future innovation."

Abertay has made quite a name for itself as a go-to uni if you want to break into the games industry, and recent success stories include indie developer Pixel Blimp, which has become part of Microsoft Ventures' business mentoring program. Galloway describes the company's success as "a real testament to the quality of our degree programmes which encourage our students to apply their creative and technical skills in an entrepreneurial context."

Of course, not everyone will have the time and funds for a degree. Galloway recommends the following books for aspiring game designers: *Rules of Play* by Katie Salen and Eric Zimmerman, *Game Design Workshop* by Tracy Fullerton, and *Game Feel* by Steve Swink.

"All of these texts provide detailed critique and analysis of the game design process along with useful exercises to help you establish and develop a concept, as well as aiding with the practical aspects of prototyping and the development of a solid user experience," says Dayna.

In order to understand game design, we have to go back to the start of commercial gaming in the 1970s. However crude and unsophisticated they may appear now, games such as *Pong*, *Pac-Man* and *Donkey Kong* laid down rules of design that are still in play today; they're based on repetitive concepts that are simple to grasp, but can also be 'gamed' to the player's advantage.

"*Pong* is wonderful as it's such a simple concept and stands up to this day – the way that aggressive play can come back to haunt you leads to you playing a frantic game of risk and reward," explains Dayna Galloway, programme tutor for Abertay University's game design and production management degree. "*Pac-Man* is so iconic, and it's one of the first games that truly immersed me once I uncovered its systems and formed a strategy to increase the likelihood of success."

As the '70s drew to a close, systems were seeping out of enthusiasts' garages and university research labs, into people's homes and purpose-built arcades. Arcade games in particular had to be commercially viable. They had to look like they were easy to beat – to get your initials next to that high score – but they also had to turn a profit and drain teens' quarters.

On home systems, games could offer delayed gratification and a slower pace. According to Galloway, "*Tetris* deserves a mention as it has such a clear and rewarding loop of core gameplay – easy to pick up and difficult to truly master – and it also managed to achieve broad appeal across the spectrum of players. And *Super Mario Bros* is just a masterclass in good design."

The '80s became the '90s and new forms of gameplay emerged. 3D, which hit the mainstream with *Doom* and *Wolfenstein*, gave us multilayered levels to explore. The internet meant that people could play with or against each other. Core gameplay values and mechanics changed very little, though – a shooter is ostensibly just a platformer from a different perspective, and an MMO is much like playing *Warhammer* (albeit remotely rather than face-to-face).

But systems were perfected, control methods were honed, graphics were sharpened and gaming evolved. This decade also saw the beginnng of the series that Galloway believes has come to define good gameplay: *Half-Life*. "With the proliferation of narrative FPS games nowadays, we very much take for granted how innovative and truly ground-breaking this series was," he says.

Why are Valve's 1998 shooter and its 2004 sequel so highly regarded? "The use of environmental storytelling to make the player question and consider the events that have taken place," explains Galloway. "The implementation of intuitive, environmental puzzles that reward the player and provide a release of tension; the characterisation of Gordon Freeman within the confines of a silent protagonist; the rich, believable world that set the bar for art direction in games; and the artificial intelligence of the many foes that would aim to bring your adventure to a premature end."

Abertay students learn about the structures and dynamics of games

Crytek and Deep Silver agree on a distribution deal

SURFACE TENSION

This buildup and release of tension is arguably the most important part of game design. It's long been known that games stimulate the production of dopamine in the brain, which explains why they can become addictive. Emerging victorious from a drawn out battle in *World of Tanks* or working out the solution to a puzzle in *Hack 'n' Slash* causes a frenzy of hormones in the brain, which makes us eager for the next challenge.

Games aren't just pleasure-inducing lightshows though – even the most abstract titles have to have some basis in the real world, be it a rectangle with emotions or an anthropomorphic cement blob.

"The best games use affordances and metaphors that we understand from the real world," says Galloway. "They treat the player with respect and give the player space and time to make connections with the objects, characters and places present in the game."

As we play games, we begin to understand how their worlds work, and what we can and can't do. At the same time, games have to introduce concepts of movement and interaction, and, guide the player forwards. They have to do so in an understated way, because to force a gameplay concept on the player would immediately break their suspension of disbelief. "Developers have to manage the player's expectations of the game and provide believable reasons for the constraints on their freedom within the world," says Galloway.

For this reason, games use subtle cues to guide the player to the rewards. In *Fallout 3*'s dungeons flaming barrels and wall-mounted lights indicate which path to take. "'Breadcrumb trails' are used to

DayZ: changing everything we know about games. And zombies

attract the player's attention through the use of colour, lighting, form, movement or even just strategically placed objects from the game economy such as health pickups, loot or discarded notes," says Galloway.

Rewards don't necessarily take conventional forms, and a plot twist, a snippet of backstory or a stunning view could be every bit as gratifying as a new weapon or a loot drop. *Half-Life* is regarded as a pioneer in this respect because it seamlessly tied the narrative into the gameworld – as well as finding monsters around the corner, you uncover the revelation that the marines have turned up to nuke the Black Mesa facility rather than save its brainiac workers. It was this more cinematic, long-game approach to sustain and release that brought *Half-Life* and its ilk in line with film and television.

"Games utilise similar elements to film and television to engage the player," says Galloway. "As an audio-visual form, games can grab the attention of the player and manipulate their emotions through the use of cinematic style camera work, expressive lighting, sound design and music. Games also use traditional techniques such as characterisation, drama, story and plot to draw the player into a world."

Recently though, game design appears to have rubber-banded on itself. Generation X, who grew up in the '90s and '00s, created the language of modern gaming, but a new generation – millennials – have spoken this language since

Each and every starship in *Star Citizen* goes through an exacting design process

Tips from the top

Crytek's Patrick Esteves gives us the lowdown on making your own game

"Start with something small that you can actually complete. It could be a platformer, a board game, or even a simple card game. It's important to begin with a manageable project so you can experience all of the phases of game creation, and it will help you to identify your weak spots and also strengths as a designer. Once you've got a couple of these cycles under your belt, you will hopefully see the same mistakes over and over again and be able to correct them.

"You need to be brave enough to toil in the dark lands of iteration and failure, letting people play your game early, knowing full well that it will most likely suck the first few times. Do this early enough so you have time to fix most of the things that suck.

"Approach everything with a clear mindset about what you want to achieve, but with a sense of humility as you are likely to be wrong. Once you're comfortable with that happening on a regular basis then you can get on to actually finding the magic. This process of failure and limited success is the grind that all game designers must endure before finding that breakthrough moment.

"This, in turn, will lead to your proudest moments as a designer: when people play your game and understand what you and your team were trying to say or do. It might sound simple enough, but appreciation of all the hard work you've put into something from your audience will always be the best reward. It is, after all, entertainment we are making."

birth, and are now coming up with new and interesting swear words. "We are seeing the emergence and critical success of games that use systems and mechanics in provocative, innovative and thoughtful ways" says Galloway.

"Titles such as *Papers, Please*, *9.03m*, *Gone Home* and *DayZ* all embed meaning within the individual elements and systems they present to the player," he continues. "Every choice and action undertaken by the player has a consequence – so whether a survivor in *DayZ* decides to check one more apparently deserted barn, or momentarily trust another player by providing them with a spare weapon, takes on a greater significance and essentially becomes an exciting, emergent playground of cause and effect."

BUILD THE PLAYGROUND

But the psychology of games is only half the battle, and a designer facing a deadline is going to be more interested in making sure that character's heads don't float off due to a programming error than the Freudian semiotics of a sword design. "In the games industry you are always faced with time constraints; developers always want to push themselves and the games they are working on," says Patrick Esteves, design director of Crytek's gladiatorial combat title *Ryse: Son of Rome*.

From a commercial perspective, games need a unique selling point in order to differentiate them from the masses of similar titles. With *Ryse*, it was "always about creating a cinematic gaming experiencing, where the player was taken through the grandeur and gutter of the Roman Empire," says Esteves. "Gameplay wise, it was built around players engaging in the brutally honest combat of the age as a soldier rising through the ranks."

At the very foundation of every game is a game design document. This huge blueprint details every aspect of the game, and includes concept art, character descriptions, diagrams of particular mechanics or plot iterations, level overviews, musical cues and menu design. They become bibles that are referenced through every stage of development, and frequently altered or updated as designers realise what does and doesn't work.

"As you develop a game you start with an idea, and build on that idea," says Esteves. "During that process you make the leap from paper design to functioning in-game, and it's not always the case that what was on paper was as fun to play as you originally envisioned. At that point the team rallies behind what is functioning in-game and makes changes to get it to play and feel as good as possible."

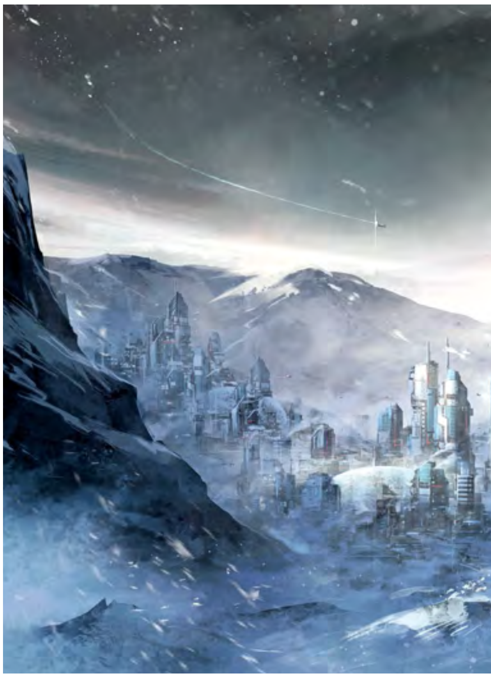
But as with any creative process, divorcing yourself from your favourite ideas can be as painful as a poker to your privates. "People will tell you that you should not get married to your ideas, but that is not possible – unless you are a robot," says Esteves. "You can work months honing a mechanic or system that might just not work, or there might not be enough time to finish. Whatever the case, it's a bitter pill to swallow, but it comes with the territory."

Ryse began as an Xbox One launch title published by Microsoft, but Crytek and Deep Silver handled the PC re-issue. This method of production is as old as games themselves, but it massively increases the pressure on the developer to meet deadlines and get the game out of the door. A new generation of companies, such as Valve and Cloud Imperium Games, are rejecting this model and self-publishing their titles.

"We sit round the table and we don't have discussions about, 'We've got to ship four million cartridges

> "People tell you not to get married to your ideas, but that's not possible"

Concept artists and designers collaborated on *Star Citizen's* enormous vessels

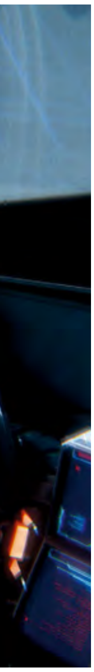


Realism and immersion are priorities for Cloud Imperium

79 M
IN RANGE
07

Ryse marked a big change from the shooters Crytek is known for

Erin Roberts believes function should guide form in game design



on this date, and the marketing is going to spend this sort of money,'" says Erin Roberts, studio director of Cloud Imperium Games' space combat title *Star Citizen*. "We just sit there and say, "what's the best thing we can do for the game?"

CITIZEN'S ADVICE

Star Citizen began in October 2012 with a crowdfunding campaign by Chris Roberts (Erin's brother), which attracted an incredible $4.2 million. But it didn't end there: by June 2013 it had reached $10 million. Erin jumped on board at $17 million. In September 2014 it had funds totalling $55 million at its disposal. It's clear that this new way of funding interactive entertainment requires a whole new approach to making games.

Fortunately, Cloud Imperium had success in mind from day one. "We always had a very long-term plan for what we were going to do," says Roberts. "The fact that the crowdfunding's taken off to such an extent has allowed us to put in a bunch of the stuff we wouldn't have at first. We haven't really changed the idea of the game, but we certainly have increased what we're working on, and the fidelity."

Star Citizen's design is shaped as a series of modules, each of which is positioned within the game's universe and tackles a different area of gameplay. It's an all-encompassing approach that makes it remarkably hard to nail down the game in terms of genre and next to impossible to review – *Star Citizen* has become a gaming format and ecosystem unto itself. But it's also the best way to get the game working – Cloud Imperium has released modules in dribs and drabs, satiating the thirst of eager backers and reiterating the game based on their input and ideas.

"You've got hundreds of thousands of people out there and you're working on their dream for them," says Roberts. "We work on it, and when we have something really cool to show we put it out to the community, and we get feedback from them. Then we work on some more stuff. I just can't think of a better way of making games right now, as long as you've got the right people making the game, and the community behind it."

Erin and his brother can't grant miracles and – we hate to say it – they probably aren't going to live forever. But they are building an entire universe – one more complex than anything ever imagined before. And they're living proof, surely, that mankind has just taken one more step towards godliness. ■

Ship building

How exactly do you design a detailed, kilometre-long ship? Erin Roberts of Cloud Imperium tells us

"In the old days, on *Wing Commander*, some guy would come up with a nice concept of a ship, some guy would model it, and if it looked cool that was pretty much it," says Erin Roberts nostalgically. Now, however, huge advances in the power of gaming hardware combined with gamers' growing needs for realism have made creating assets a hugely arduous process.

"Now, we come up with a design spec for what we want the ship to be – what kind of class of ship it is, what its role is," Roberts explains. "Once we have that decided we do a quick concept of it, just for look and feel. That goes to the designers to do a full whitebox, which is where they make a 3D layout of exactly what the ship will look like from a design perspective, how the ship works. This includes everything from where it's flown from, what different kinds of areas there are on the ship. If it's a fighter it's just the cockpit, but if it's a large ship there's a mess hall, an engineering area."

"Then that goes back again to concept, who take all that information and build a working 3D model. What we're actually doing is more like product design – we say everything has to work like a jetliner would work now. So if there's an undercarriage, where does it come out from? How does it operate? How does it animate? When it disappears, where is it stored? The big thing we're trying to do with the game is create the huge sense of immersion, so people play it and feel like it's believable. We go to this huge level of detail in everything we do, so when people play it they see how it works."

2 HOURS

Advanced streaming

Turn your gaming into a professional performance, says Richard Cobbett

PROJECT GOAL

Create professional quality streams

Get the best video quality and configure your tools for the audience's benefit.

REQUIRES

Open Broadcasting Software

A fantastic freeware tool. For now, use the 32-bit version.

Good connection

Without one, you're best off sticking to Let's Play. Streams take a lot of bandwidth in both directions, and not all home connections have good upstream.

Were there any doubt about how big streaming is, it vanished as soon as Amazon spent just a smudge under a billion dollars to acquire the biggest portal, Twitch.tv. At the time of writing, over 125,000 people are watching games of *Dota 2*, over 34,000 are sitting in on *Hearthstone* duels, and proving that it's not just the big games that draw an audience, almost 25,000 are watching others jump at *Five Nights at Freddy's*, an indie game about watching the cameras in a tacky restaurant full of killer robots in animal suits.

As ever, taking part really isn't that hard. Twitch is directly integrated in several games, including *Minecraft*, as well as both next-gen consoles; on Xbox One, you say "Xbox, broadcast" and you're done. But we use PCs, and we can do a hell of a lot better than that – provided we have a broadband connection capable of it.

Unfortunately home broadband connections are heavy asynchronous – your 50Mbps download will likely have a single-figure upload speed. For full-resolution streaming, you're looking at around 10Mbps and up. It's possible to downscale a little first though, squeezing acceptable performance onto weaker connections, and most streamable games are fine with that.

Of course, you don't need us to tell you that it's best to dedicate your connection for the duration

TOP TIPS

DRESS REHEARSAL

Test your stream well before telling anyone about it – if things go wrong, it's best if there isn't an audience around to witness it.

Making money – possible, but not easy

The main way to make money from streams (ignoring arrangements like promoting a product) is by partnering with your streaming provider. If you don't do this, it keeps all the cash from any ads. As a Twitch partner you get a share, plus the ability to time commercials to appear between games, and at high levels, the ability to offer subscriptions to viewers.

The catch? You need an average concurrent viewership of 500+ people and at least three regular broadcasts a week, or 100,000+ subscribers if you're on YouTube or similar. Hitbox has a similar deal, with a lower base requirement of 100+ people. It's possible to make a case that your popularity elsewhere will transfer, but suffice it to say that you're not going to be cashing cheques just by streaming your *Dota 2* team unless it includes Wil Wheaton, Felicia Day and the Dark Lord Sauron running support.

Let's play together
hitbox Partner Program
hitbox
Partner Features
Transcoding
Monetization
Subscriptions
Apply

The most popular streamers draw huge audiences. Between 10 and 100 is reasonable for most normal folk

– no torrenting, no iPlayer in another room, no uploading backups. However, it's also worth looking into an alternative to wireless connections if possible – ideally a direct Ethernet link to your router, even if it means temporarily laying down a long cable, or powerline networking if your PC is too far away.

On the streaming side, there's no shortage of options and it's possible to do everything for free. It's also possible to invest in all kinds of tools. A capture card like the Elgato, for instance, might seem ridiculous given that you can record the screen without help, but its benefit is being able to shunt footage to a second PC that can handle things like integrating cameras, bringing in other people via Skype, and doing the grunt work of creating a video feed without soaking up your main PC's processing power or forcing you to play the game in a window to still keep tabs on what other people are saying. Likewise, the software available ranges from free (OBS) to affordable (XSplit, $25 for three months) to "Christ!" (Livestream, $799).

Tooled up

For the most part though, you'll already know if you need these tools, and thankfully the free option is also one of the best. Open Broadcaster Software. (www.obsproject.com) isn't always the most stable program, but it'll provide just about everything you need. For example, as well as simply broadcasting video, you can prepare scenes (such as cards that will appear before your stream starts for real) and switch between them at a keystroke. At a more advanced level you can take complete control. For instance, if you've decided to stream a *Dota 2* match, you might create a frame for the whole game, but you can also bring your face onto screen when you want to talk. Or for something like a Let's Play, you can address the audience full-screen during the introduction, but then move yourself into a corner out of the way so that full attention can go on the game itself.

Jargon buster

Twitch
The fan name for Twitch.tv. Like Hoover, it's become synonymous with streaming, though other options are available.

Livestreaming
Broadcasting live to an audience online, complete with a chat window for their participation.

Unlike some tools out there (particularly the free versions of ones with a commercial side), OBS isn't limited to specific hosts. It comes with presets for the most popular choices, which right now (in descending order) are Twitch, Hitbox and YouTube, but any other service can provide connection details. It also offers some very useful extra options, including the ability to downscale your video, broadcast at lower quality levels if required, and take a local copy for archiving purposes. Sites like Twitch used to have reliable archives, but this can't be expected any more. Its focus is increasingly on 'highlights', with its audience primarily being interested in live shows, and Twitch capping highlight videos at two hours. As such, for online archiving, it's best to put a copy on YouTube.

TOP TIPS

CHOOSE CAREFULLY!
Not all games lend themselves to being streamed. Anything with lots of text especially is probably a mistake – it will be impossible for viewers to read on YouTube.

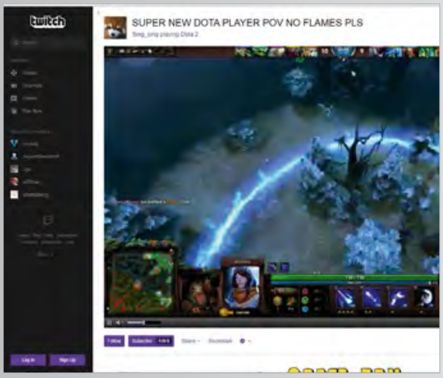
Do it yourself

Recording live on your own PC means you'll get the best possible quality, without any temporary blips or disconnections in the final broadcast. It's also worth noting here that these blips won't necessarily be on your side. If your stream coincides with a big event such as the *Dota 2* International for instance, the streaming servers are going to be fairly strained. Occasional drop-outs also sometimes just happen, and the time taken for a reconnection is simply more obvious in a livestream. It won't always be obvious at the time either, both because your attention is going to be primarily on the game rather than the chat window, but also because there's inherently a broadcast delay when streaming. This can be up to – or over – a full minute, which is a long time in video, but at best is going to be around 10 seconds.

Whether you've got someone on hand to help or are going it alone with free or commercial tools, it's easy to make something very cool. Let's take a more detailed look at using OBS to create a stream.

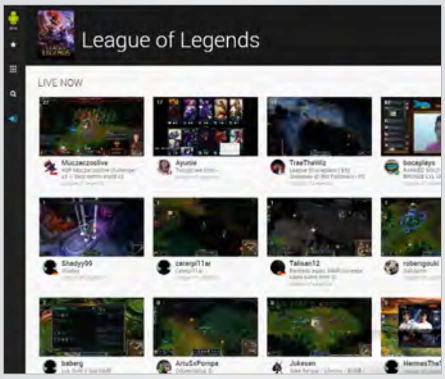
Streaming hosts

Which site should you use for streaming, and to build an audience?



1 Twitch.tv

Twitch is the biggest site by far, though that's had knock-on effects in terms of its reliability and performance. The long stream delays and chance of losing connection to chat are both a real pain. If people are going to search for a game though, they'll do it here.



2 Hitbox

This is the up and coming alternative to Twitch. It's smaller but cleaner, and tends to have better performance. If you're going to bring an audience from elsewhere, like a blog or a YouTube channel, it's likely the one to use (until it gets cluttered).

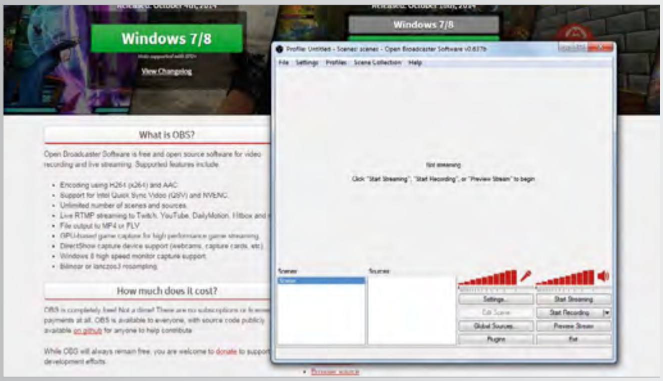
SUPER SMASH BROS. 3DS
3DS FC: 5198-2418-9896
Super Smash Bros. for Nintendo 3DS, Mario Kart 7 & Mario Golf World Tour (10-19-14) - Wii U & 3DS
47 watching now

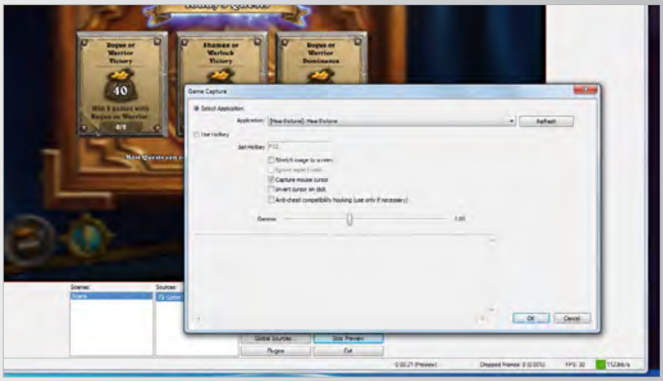
3 YouTube

If your account is in 'good standing', you can activate this for your channel. It's really more for events though, and Content ID runs live on it, which can switch you off mid-flow. Use YouTube for storing streams after, but stick with other services for making them.

Creating and designing your stream

OBS makes it incredibly easy to create a good quality production


Windows 7/8
What is OBS?
How much does it cost?
Not streaming
Click "Start Streaming", "Start Recording", or "Preview Stream" to begin
Settings...
Start Streaming
Edit Scene
Start Recording
Global Sources...
Preview Stream
Plugins
Exit

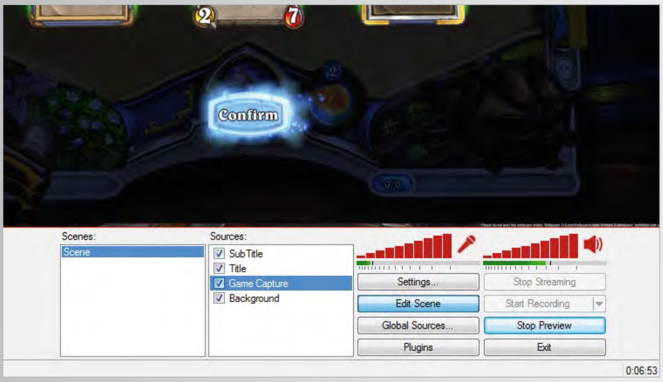

Game Capture
Refresh
OK
Cancel

1 The 64-bit disadvantage

Download OBS from https://obsproject.com. Normally, you'd want the 64-bit version, but this time go with the 32-bit. This is because many of the plugins are only compatible with that version, and the slight performance boost you may get from 64-bit is made up for by the extra stability. The two are functionally the same if you don't encounter problems, and don't need any unsupported plugins.

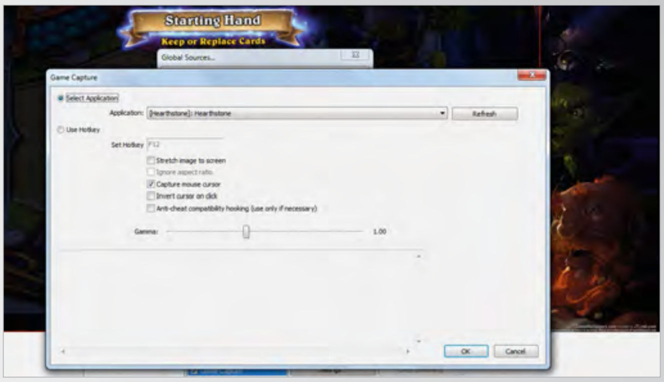
2 A blank canvas

Each OBS scene can contain any number of 'sources', as well as elements like imported pictures and text. Game Capture is the most efficient way of bringing in game footage, though not always compatible. For older titles especially, Window Capture is often needed instead, or even a workaround like using a tool like DXTory to snag the video and then passing it across to OBS to be streamed.


Scenes:
Scene

Sources:
☑ Sub Title
☑ Title
☑ Game Capture
☑ Background

Confirm
Settings...
Stop Streaming
Edit Scene
Start Recording
Global Sources...
Stop Preview
Plugins
Exit
0:06:53


Game Capture

● Select Application

Application: [Hearthstone]: Hearthstone

○ Use Hotkey

Set Hotkey F12

☐ Stretch image to screen
☐ Ignore aspect ratio
☑ Capture mouse cursor
☐ Invert cursor on click
☐ Anti-cheat compatibility hooking (use only if necessary)

Gamma: 1.00

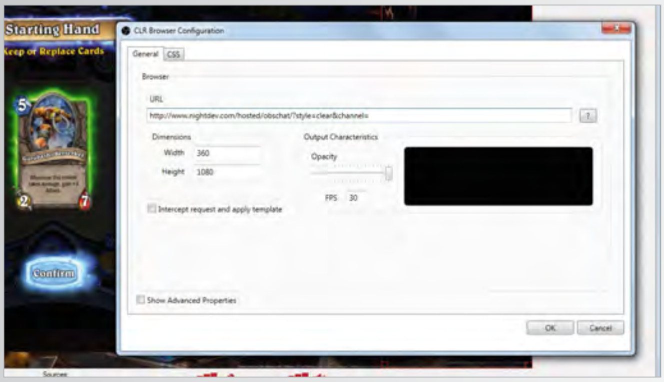
Starting Hand
Keep or Replace Cards
Global Sources...
Refresh
OK
Cancel

3 Laying things out

Click 'Preview scene > Edit scene' to lay things out. Right-click 'Sources' to add things like an image or text. Select them and you can drag them around the screen (having first chosen a resolution in the Settings menu). Resizing most items is as easy as dragging the corners. However, this will only stretch some elements, like chat windows. To give them more space, double-click to edit them directly.

4 Global Sources

The difference between Sources and Global Sources is that Sources are instanced every time you load that scene. For something like a game video, that's a problem – you don't want it cutting every time. If you add your Game Capture source in Global Sources, OBS will keep on streaming it whether it's visible or not. You can still move it around, resize it and everything else, but there won't be interruptions.


CLR Browser Configuration

Browser

URL: http://www.nightdev.com/hosted/obschat/?style=clear&channel=

Dimensions

Width: 360

Height: 1080

Output Characteristics

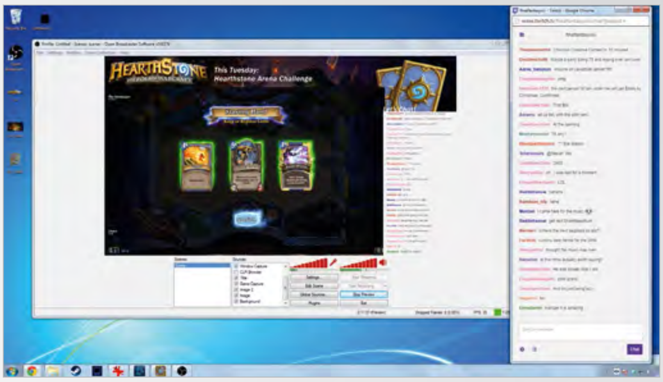
Opacity

FPS: 30

☐ Intercept request and apply template

☐ Show Advanced Properties

Starting Hand
Keep or Replace Cards
General
CSS
?
OK
Cancel
Confirm


HEARTHSTONE
This Tuesday:
Hearthstone Arena Challenge

5 Integrating chat

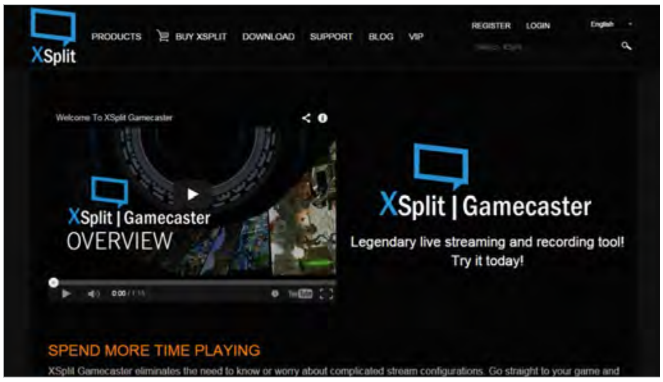
It's a good idea to embed chat in your stream to add a sense of life, but it's not the easiest thing to do. For Twitch and Hitbox, which use IRC, try www.nightdev.com/obschat instead of trying to hook in directly; Twitch's web chat interface isn't the most stable. These tools will spit out text in the colours, sizes and positions you want.

6 Bringing in the web

If you're using something else, or want to import other web content, use Window Capture. Resize the active part of the screen as before. To crop it, hold down [Shift] when resizing and slice off everything but the part you need. You can put this wherever you like, but you won't have as much control over how it fits into your stream.

Investing in streaming

If you find yourself hitting your limits, here's how to break them



Legendary live streaming and recording tool! Try it today!

SPEND MORE TIME PLAYING

XSplit Gamecaster eliminates the need to know or worry about complicated stream configurations. Go straight to your game and

1 XSplit ($24.99 for three months)

If you find OBS isn't working for you, XSplit is the first step on the commercial ladder. Having to rent instead of buying it is a pain, but it offers a slicker, more stable experience. Its Gamecaster application also offers some handy features like availability within games using an overlay, and the ability to scrawl on the screen to quickly make a point or highlight something.

2 Elgato Game Capture HD60 (£140)

Game capture gear is mostly aimed at consoles, but a dedicated unit can both boost your PC's performance and enable you to do all of your broadcast setup and stream monitoring from a secondary machine. This one handles video at up to 1080p/60fps, though 30fps tends to be better for streaming right now. And should you want to record from a console, you have the gear ready.

3 Webcam/lights

Webcams have a bad reputation for picture quality, but often the reason for grainy images is that they are struggling to cope in low-light environments. Invest in a basic lighting rig (see below) and an HD camera like the Logitech c920 (pictured) and you can get great quality whether you fill the screen or not. Bear in mind that even if you've got a well-lit room, standard fluorescents are no replacement for a good 5,500K bulb (the temperature of daylight) pointed exactly where it's needed.

Carl Zeiss Tessar HD 1080p
Logitech

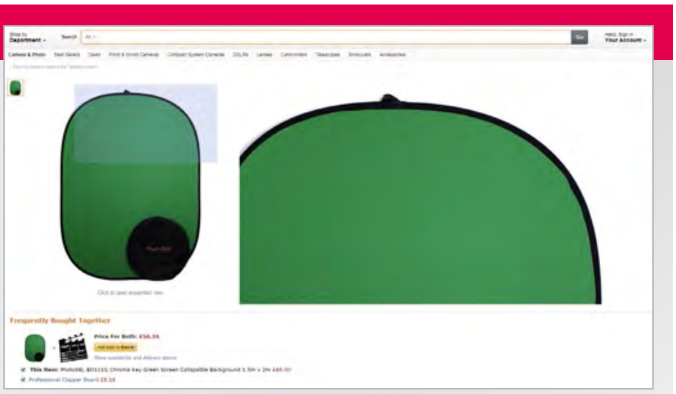
4 Microphone

You don't absolutely *need* a super-high quality microphone to record your commentary while you're streaming, but something more than a basic headset certainly won't hurt. If you're willing to splash out on something decent, the Rode Podcaster (£160) is a great USB one with optional arm (£70) that's perfect for streaming, not least because it picks up almost no background noise. Some popular alternatives include the Blue Snowball (around £50) and the same company's Blue Yeti (£115), with a stand to get it close to your mouth.

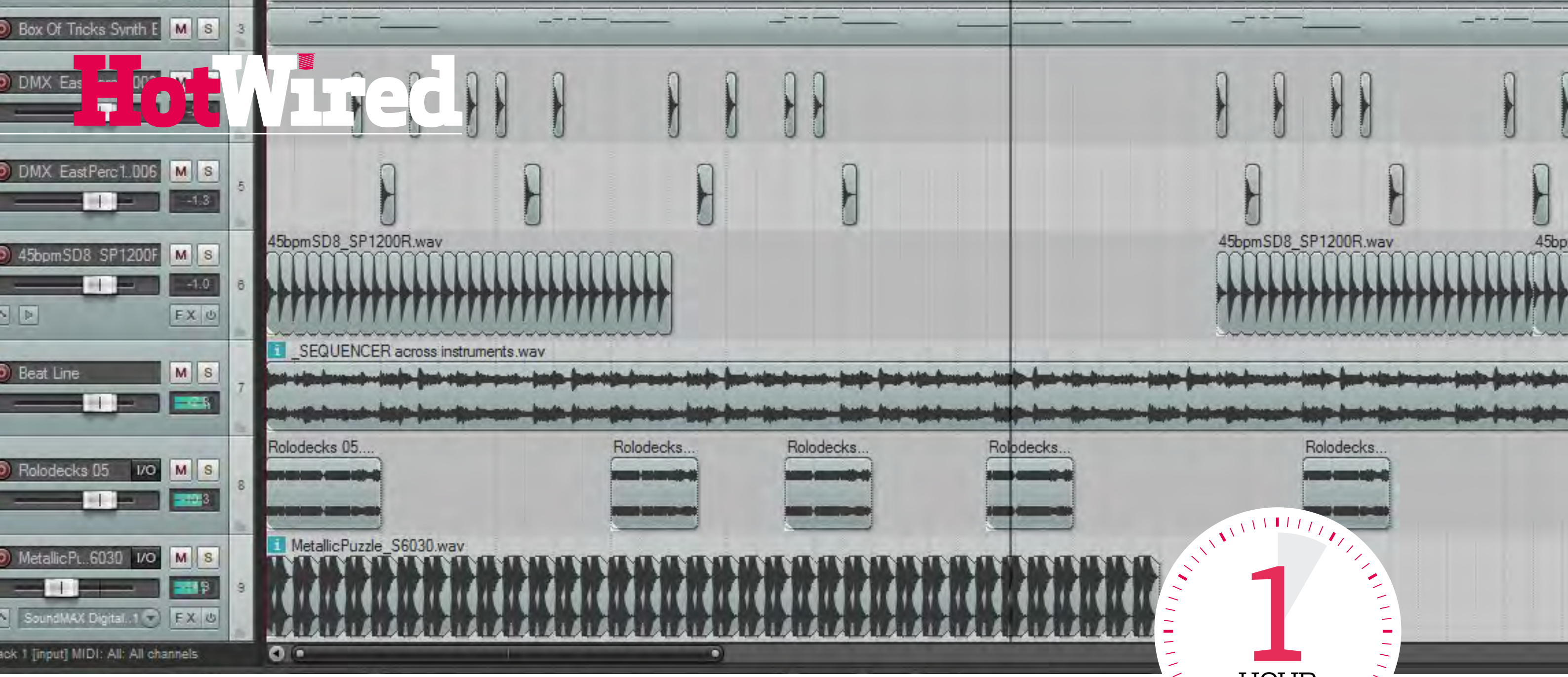
The art of greenscreen

For starters, you'll need a screen. An ordinary bedsheet won't usually cut it due to being translucent. A basic opaque muslin sheet will cost around £13 and a basic stand to hang it from if needed will add £30-50. Another option, which won't take as much tedious ironing, is a collapsible background like the Photosel 1.5 x 2m background, which is around £50 on Amazon. Again, you'll need to prop it up or hang it from something. The big sheet is the best way to go though, offering far more space to play with when setting up your camera.

Next, lighting. Ideally you want one stand illuminating you and another flattening the light on your greenscreen. A pair of continuous lighting kits soft boxes to diffuse the light from one or more 5,500K bulbs is ideal, and Amazon will sell you a pair for around £70. The single-bulb ones will be fine for a very small room, but you'll want a four-bulb model for anything larger. For that price they'll be rickety as heck, but will suffice. Light the screen first, then light your own face to match it. And if possible, open a window. All that light plus your PC means it'll get hot after a while.



The software side is surprisingly easy - every streaming tool has a simple sliding bar to clip out the green background. No effort at all



1 HOUR

Master music creation with Reaper

James Russell explains the ins and outs of this fully-featured music platform

PROJECT GOAL

Make your own music
Get the software set up, program virtual instruments, work with audio, do some simple mixing and render everything at the other end.

REQUIRES

Speakers/headphones
If you're making music, you'll need to hear what you're doing. A pair of headphones or speakers will do. To get serious, look into studio-grade gear.

MIDI keyboard
It's certainly possible to work without a keyboard if you're happy to click notes into existence, but for any lengthy project a MIDI controller will alleviate the burden and help the music flow more easily.

Reaper is available to download from http://www.reaper.fm/download.php. It's a fully featured DAW (digital audio workstation) that runs on a fairly generous trial licence. Once you've finished evaluating it, the discount licence costs just $60 (roughly £37).

Music creation in Reaper revolves around tracks, each of which carries audio data for playback. You can create as many tracks as your system can handle, then play them back simultaneously. Each track can be muted, soloed, panned left/right and have its volume changed.

Reaper's main interface is split into two parts. In the top panel, tracks are arranged in a column on the left, and the audio data they play spans from the middle to the right-hand side. This is where you edit and move music around. The same tracks are displayed in the bottom panel, arranged in a horizontal row for mixing and processing purposes. Think of it as two different representations of the same bunch of tracks.

It's analogous to the old system of recording audio onto tape and processing it through a mixer. The top panel, with its editable audio data, can be thought of as the tape, and the bottom panel is where the processing is performed on each channel. Keep in mind that this bottom-panel processing isn't 'destructive' processing – the audio data always remains the same underneath, and effects are applied in real time over the top.

First steps

There are plenty of common stumbling blocks when you start to

Ins and outs of audio interfaces

Your motherboard or discrete soundcard probably provides you with a couple of inputs and outputs in 3.5mm jack form, but you're going to need something better if you're ready to take making music more seriously. An external audio interface acts very much like a sound card, but one that's designed specifically for use with digital audio workstations. If you're planning to do any serious audio recording with a studio-quality microphone, a good quality interface will be well worth the investment.

The advantage of an audio interface usually lies in its ability to input and output via XLR or ¼-inch jack cable, and – depending on the model – MIDI cables to hook up certain digital instruments.

Install your interface's driver and choose your new interface as the input and output by selecting 'Preferences > Audio > Device' in Reaper. As well as being able to monitor Reaper's output through the interface's headphone jack, you'll be able to record multiple channels or instruments (as many as your device can host) in real-time, before the audio hits your computer rather than after.

Get some proper outboard gear

Focusrite
Scarlett

work with audio. It's important to set up the correct routing before you get going. That means your software must understand what hardware will be providing the input (be it a microphone, line in or digital keyboard), and what it should output to (your speakers or headphones). After this, you may still have to select the specific input you're using at any time on the track you want to record on. We go through this in the walkthrough a the bottom of the page.

When you're recording audio on a PC, you also need to consider a new audio driver. An ASIO driver cuts out much of the time delay between inputting a sound and hearing it play back while doing so. Obviously, it's best to cut down on any delay or 'echo'. If your audio hardware doesn't offer an ASIO driver as standard and you can't find one on the manufacturer's website, you can find a generic ASIO driver at www.asio4all.com.

Musical programming

If you're working with pure audio, you can import it into Reaper by clicking 'File > Import', or by simply dragging files in from Windows Explorer. We'll explain how to make new recordings within Reaper in the walkthrough overleaf.

You can also create an Instrument track, which (as the name implies) allows you to program a virtual instrument within Reaper. You can select this instrument from a list of options that come with Reaper by default, or download a new one (see below). The selected instrument's track handles MIDI rather than audio data.

MIDI is a user-friendly way to program notes into a timeline, and the selected instrument will then play what you've written back to you. To get started, draw in a MIDI item using the pencil on your virtual instrument track in the top panel. Double-click the tool and you'll see the MIDI note editor, where you'll be able to draw in notes corresponding to the keyboard visualisation on the left-hand side, at times corresponding to musical beats and bars displayed along the top.

Jargon buster

DAW
Digital audio workstation. Reaper is one, as are Pro Tools, Cubase, Studio One and FL Studio.

Plug-in (VST)
An extension to your DAW. Plug-ins come in two main flavours: instruments, such as synths or pianos, and effects, such as equalisers and reverbs.

TOP TIPS
MOUSE MODIFIERS
Hold [Shift] to disable snapping the grid. Hold [Alt] to stretch audio (without changing its pitch). Hold [Alt], right-click and drag to select items with a marquee.

Plug it in

It's easy to expand your audio setup. Reaper comes with a lot of great plug-in effects and instruments that you can load onto tracks by clicking an FX slot and selecting the necessary item from the list. These VST plugins can be found online (see 'Get more instruments and effects' on p87), and downloaded for use with Reaper or any other DAW that uses the same plug-in format.

Again, the processing done by effects plug-ins is non-destructive, so you can save and tweak your changes safe in the knowledge that the audio will remain the same underneath.

Insert effects are explained in the third tutorial, but there are Send effects too. These effects (which you'll see in the lower of the two lot of slots in the bottom panel) 'tap off' a certain amount of your signal to a new track. This is useful for combining several tracks so you can perform FX processing on all of them at once. Just elect to send the tracks you want to the same location (aka bus), and their audio will also be present on a new mixer channel in the bottom panel. Now, if you place an Insert effect on that new channel, you'll be processing all of those tracks together, the amount of each being determined by the amount you 'tapped off'.

TOP TIPS
APPLY TO MORE TRACKS
To make changes to multiple tracks (such as muting and soloing), activate the button on one, then hold the mouse button and drag towards the others to apply it across the board.

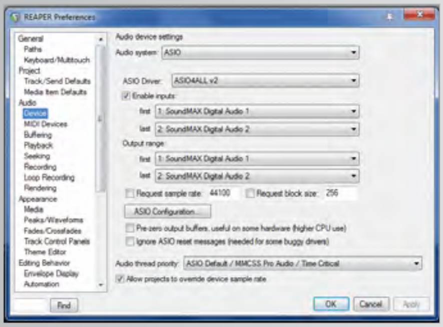
Get it back out

When you've finished making tweaks, it's time to get the audio out of there again. Reaper comes replete with all the pro codecs that other programs often leave unusable, and there are loads of options to help you select what to export, and at what quality.

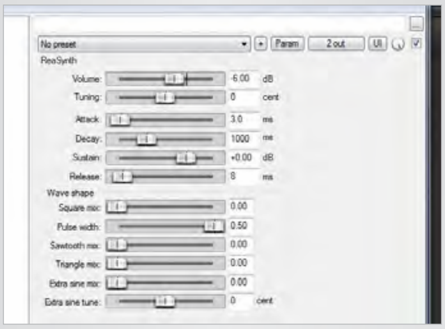
If you're happy with Reaper, don't forget to grab the non-commercial licence for $60. It won't provide you with any extra functionality, but it will make you feel warm and fuzzy inside and help keep Reaper alive.

Getting started

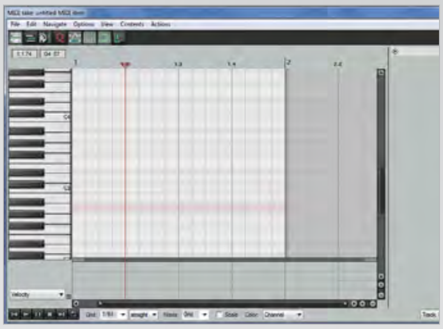
We'll load up Reaper and point everything to the right places



Audio device settings
Audio system: ASIO
ASIO Driver: ASIO4ALL v2
☑ Enable inputs:
first 1: SoundMAX Digital Audio 1
last 2: SoundMAX Digital Audio 2
Output range:
first 1: SoundMAX Digital Audio 1
last 2: SoundMAX Digital Audio 2
☐ Request sample rate: 44100 ☐ Request block size: 256
☐ Pre-zero output buffers, useful on some hardware (higher CPU use)
☐ Ignore ASIO reset messages (needed for some buggy drivers)
Audio thread priority: ASIO Default / MMCSS Pro Audio / Time Critical
☑ Allow projects to override device sample rate



No preset
ReaSynth
Volume: -6.00 dB
Tuning: 0 cent
Attack: 3.0 ms
Decay: 1000 ms
Sustain: +0.00 dB
Release: 8 ms
Square mix: 0.00
Pulse width: 0.50
Sawtooth mix: 0.00
Triangle mix: 0.00
Extra sine mix: 0.00
Extra sine tune: 0 cent



1 Getting set up

If you're using hardware like a MIDI keyboard or audio interface, you can hook it up in 'Options > Preferences > Audio > Device'. If you're running an ASIO driver (see above), select it as your Audio System and ASIO Driver. Select your input and output audio hardware, then click 'Preferences > Audio > MIDI' to select a keyboard if you're using one.

2 Tracks and instruments

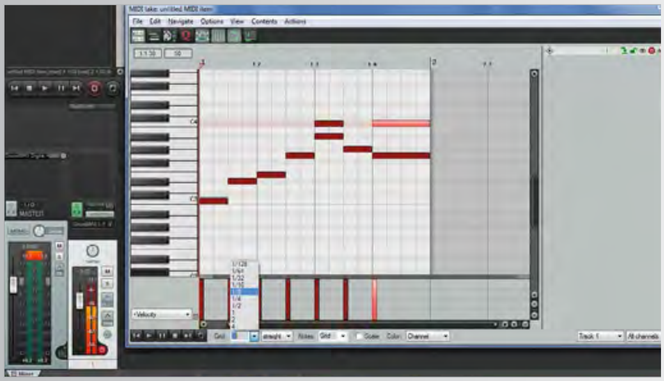
To get started, press [Ctrl]+[T] to create a new track, which will appear in the bottom panel. Click this track's 'FX' button, choose 'Instruments' from the menu and select 'VSTi: ReaSynth'. Now click the track's 'Record arm' button (a red circle) and the ReaSynth instrument should be playable via keyboard. For more instruments, check out p87.

3 Gearing up

Now go to the 'Insert' menu and select 'New MIDI item'. This will appear on the top panel. Double-click it to bring up a keyboard display. If you're not in possession of a MIDI keyboard, you can click the piano notes here to test your sound. If you find that it's not working properly, check your In/Out settings as defined in step one.

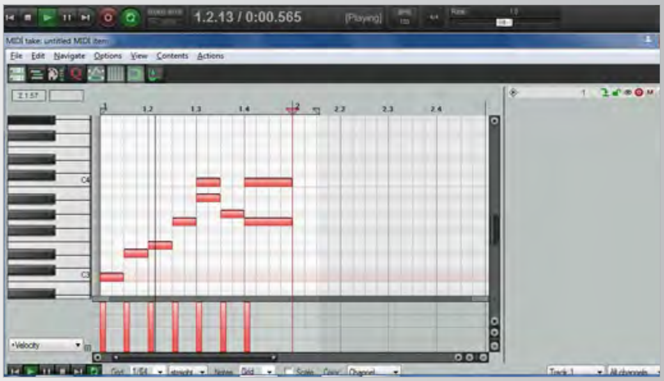
Working with audio and MIDI

This is where the music actually happens



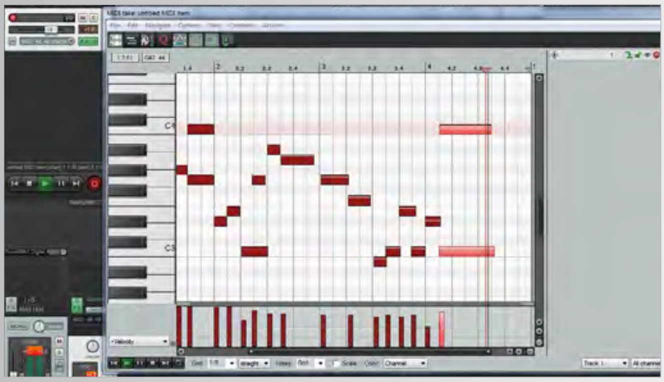
1 Creating notes

Following on, you can use the pen tool to click notes into and out of existence. To help, you can click 'Snap to grid', and select the timebase for that grid from the bottom dropdown menu reading '1/64'. Back in the main window, you can extend the entire MIDI item by dragging its edges, but only after going to 'Item > Item settings' and unticking 'Loop item source'.


1.2.13 / 0:00.565
[Playing]
MIDI take: untitled MIDI item
File Edit Navigate Options View Contents Actions

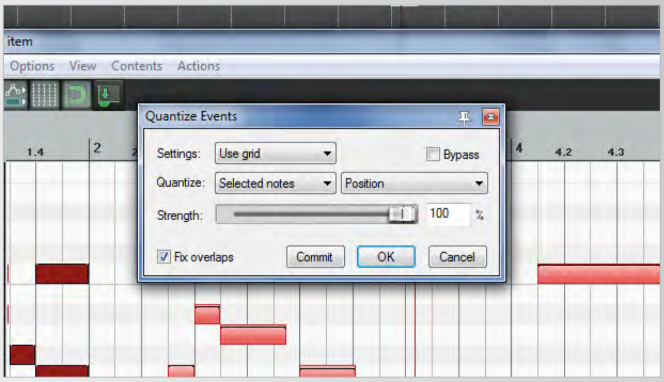
2 Playback

Select your playhead position by clicking the time markers at the top. It'll appear over your note data as a red vertical line. Select a region to play using the grey flag markers, and press [Space] or click 'Play' to play the pattern. You can loop the playback to play repeatedly between those grey flags by activating the green 'Loop' button next to the 'Play' button.



3 Recording MIDI

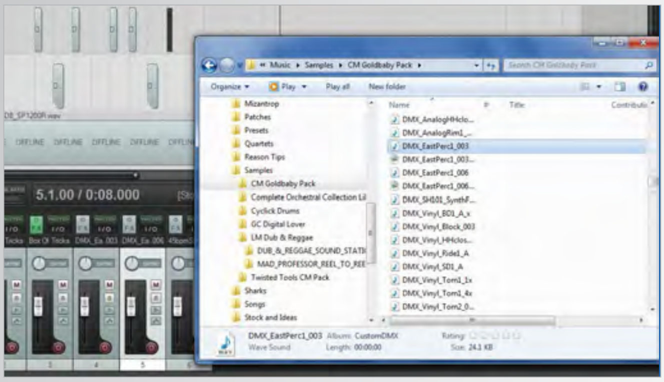
If you're using a MIDI keyboard (for a good selection, see www.gear4music.com/midi-keyboards.html), you can save a performance by pressing the board's 'Record' button. You'll have to make sure the track is set up to receive your keyboard as an input before you get started. You can do this using the drop-down menu that should have appeared under its fader in the top panel.


item
Options View Contents Actions
Quantize Events
1.4
2
4
4.2
4.3
Commit
OK
Cancel

Settings: Use grid
☐ Bypass
Quantize: Selected notes, Position
Strength: 100 %
☑ Fix overlaps

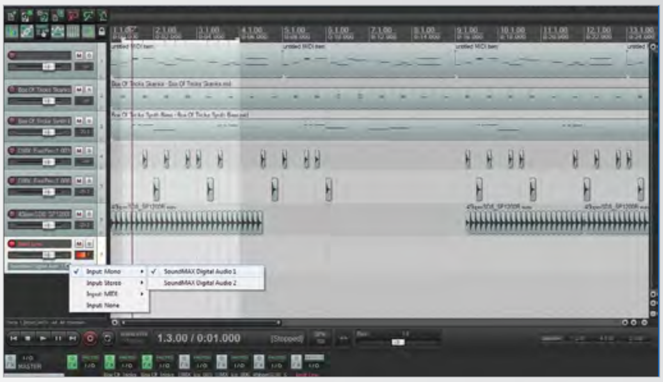
4 Quantising

Nobody's perfect, and your keyboard performance won't be perfectly in line with the grid. Select all the notes in the pattern (you can click and [Shift]-click to do this), then press the [Q] key (or the 'Q' button) to bring up the Quantise menu. Don't forget to select a grid resolution to snap them to in the bottom of the notes window (1/8 may be best) before confirming.


5.1.00 / 0:08.000
Music ▸ Samples ▸ CM Goldbaby Pack
Organize
Play
Play all
New folder
Name
Title
Contributin

5 Importing audio

Let's throw some audio into the mix. You can go to 'File > Import' to work audio files or samples into the project, or simply drag files from the desktop or Windows Explorer. Drag the edges to change their size, [Shift]-click and drag to make a copy, and [Alt]-click and drag to stretch the audio to fill a larger or smaller space.

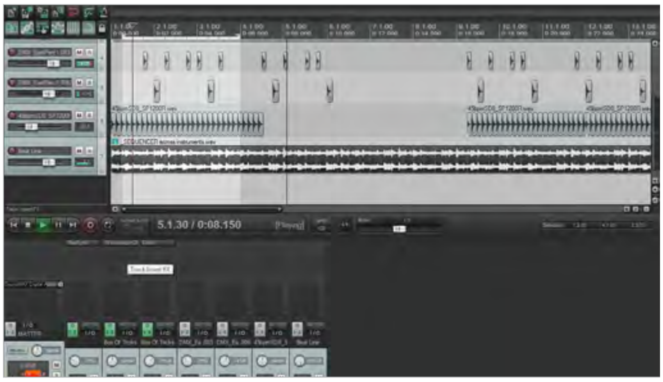

1.3.00 / 0:01.000
[Stopped]
Input: Mono
Input: Stereo
Input: MIDI
Input: None
SoundMAX Digital Audio 1
SoundMAX Digital Audio 2

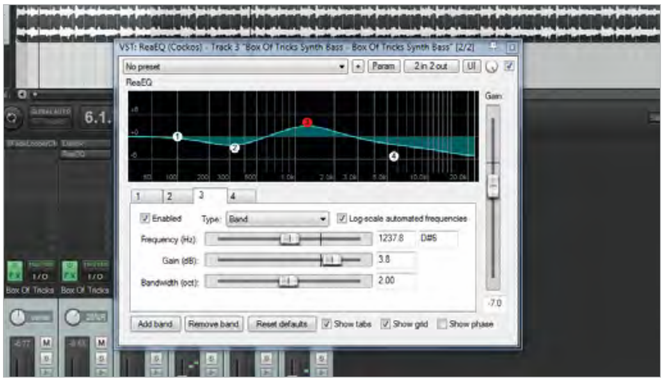
6 Recording audio

You can record your own audio as well. Arm the track using its small 'Record' button, making sure no other tracks are armed, and select your mic input in the drop-down as pictured. If the input you want isn't available, you may have to set it up in Reaper's audio preferences. Hit the big 'Record' button and create your recording!

Mixing and exporting

Create better quality audio, make adjustments and get your final work out



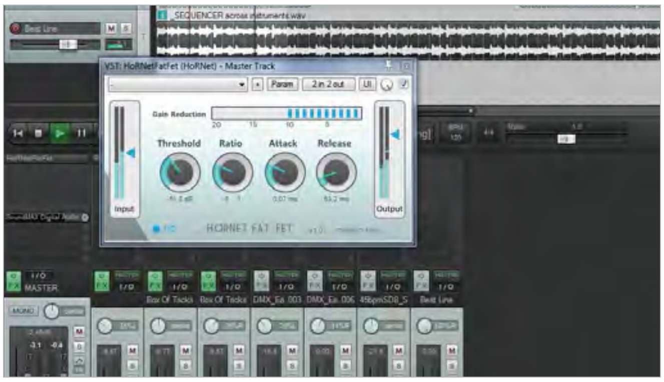


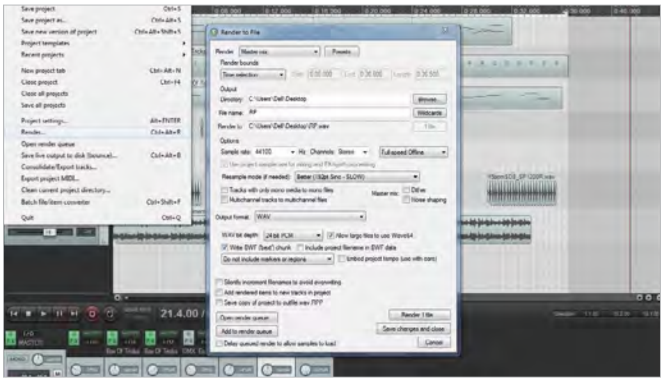
1 The mixer

Once you're happy with your music, it's time for some mixing. Increase the size of the lower panel. Each of your tracks has a volume fader, mute and solo buttons, panning controls at the bottom, and above this, slots to insert effects for creative processing. If any meters go red as you play the song back (as pictured), turn the channel down and click those red areas before trying again.

2 Insert effects

There are two types of effects available in Master Reaper – send and insert. The top column of each track is for insert effects, just click a cell and you can assign one to the track. Here's Cockos' ReaEQ insert over one track, but there are plenty more built into Reaper and available online. Effects are cumulative, so choose the order carefully and drag them around if necessary.





3 Master fader

You will find your master fader on the left. All other channels feed into this one. You can apply effects here too – as we're doing above with this VST compression plug-in. Remember that you can remove or change any existing effects. The process is non-destructive, so these effects be applied 'above' the audio in real-time rather than changing the actual files.

4 Rendering the results

Now to export the audio. Clicking 'File > Render' will take you to a screen full of options. Choose to render the Master Mix (what your master fader hears), and capture the entire project or time selection (which takes account of your white time markers). Choose your output format and destination and hit 'Render'. If you installed an ASIO driver, you may have to quit Reaper before playing the file from Windows.

Get more instrument and effects

Reaper comes with a generous stock of VST plug-in effects, which can give a new sound to your audio tracks, but it's not flush with instruments. Thankfully, there are plenty more available, if you know where to look. As well as a market in professional plug-ins ranging from a couple of pounds to several hundred, freeware options are plentiful.

There are also processors for analysis, treatment, and MIDI effects that take your note data and do weird and wonderful things with it.

You're looking for VST plug-ins, specifically. These usually come as DLL files to drop into a folder full of other plug-ins, but they sometimes use an installer, too. The VSTPlugins folder is usually located in your Program Files directory, but you can create your own folder wherever you want, as long as you point Reaper to it via Preferences. Installing plug-ins usually requires a program restart, so Reaper can see what's new in your collection. Again, this can be done in Preferences.

Grab more free plugins

Shattered Glass Audio
Ace
INPUT
VOLUME
FEEDBACK
OUTPUT
OVERSAMPLING
MODE
CAB
STEREO

There are several treasure troves of plug-ins out there. www.vst4free.com is a solid collection, divided into plenty of categories, and each plug-in is rated by other users. Our sister website MusicRadar hosts a list of its 27 favourites at www.bit.ly/MRfreeVST.

Paid-for plug-ins are generally offer more features and are more frequently updated. They range widely in price, but you don't always get what you pay for. Find out the best (or the cheapest) plug-in for the task at www.kvraudio.com. ■

Alan
Documents
Pictures
PC settings
File Explorer
Snipping Tool
Windows Feedback
People
Calendar

Don't wait – take Windows 10 for a spin

30 MINUTES

Alan Dexter shows you how to try Windows 10 without damaging your machine

PROJECT GOAL
Install Windows 10
Try the next version of the OS in the safest way possible.

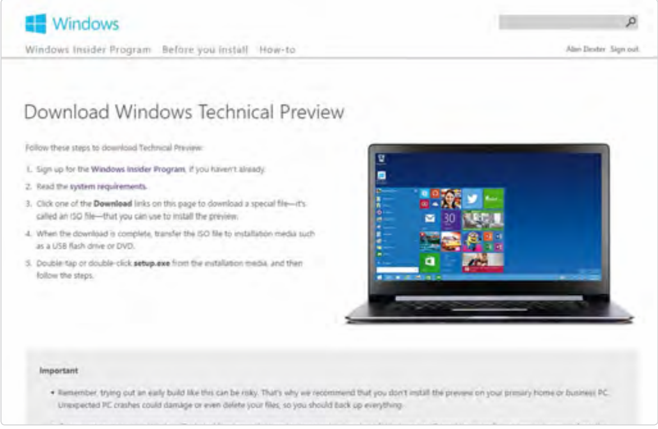
REQUIRES
Oracle VM VirtualBox
The best free VM app.

Windows 10 is lining up to be something special, and getting to grips with what's new and discovering how to do the things you used to are just a couple of the reasons why you might want to install the Technical Preview.

Installing it on your main PC isn't a great idea though, because this is a preview and thus has no guarantees about stability. Installing it on a spare machine is the preferred method, simply because you'll get a better idea of what the actual experience will be like. However, as this is an early build, it isn't in a state that you can use every day without problems – games not working, things being a bit flaky and driver issues, to name a few. Because of this, we'd recommend installing it onto a virtual machine. We'll show you how.

Step-by-step: Install Windows 10

Don't worry about making your PC unstable – install the OS on a virtual machine



Download Windows Technical Preview

Follow these steps to download Technical Preview:

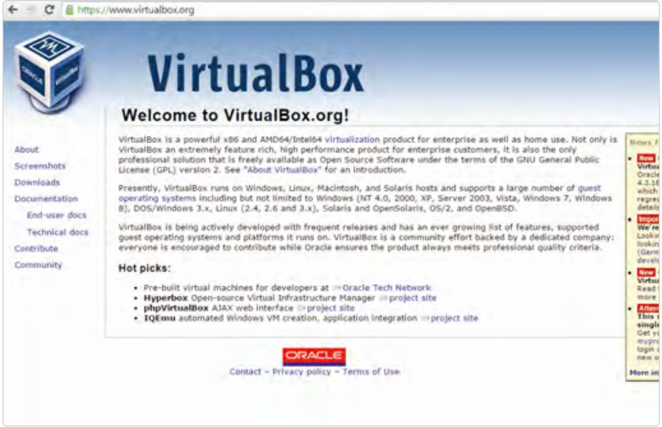
1. Sign up for the Windows Insider Program, if you haven't already.
2. Read the system requirements.
3. Click one of the Download links on this page to download a special file—it's called an ISO file—that you can use to install the preview.
4. When the download is complete, transfer the ISO file to installation media such as a USB flash drive or DVD.
5. Double-tap or double-click setup.exe from the installation media, and then follow the steps.

Important

- Remember, trying out an early build like this can be risky. That's why we recommend that you don't install the preview on your primary home or business PC. Unexpected PC crashes could damage or even delete your files, so you should back up everything.

1 Download Windows 10 Tech Preview

First, download the right version of the Windows 10 Technical Preview from http://bit.ly/1vzT9gT. Pick the language you understand best, and work out whether you want the 32-bit or 64-bit rendition. There's not much in it, but if you want to assign more than 3GB to the OS, you need to go with the latter. Write down the product key, too.



Welcome to VirtualBox.org!

VirtualBox is a powerful x86 and AMD64/Intel64 virtualization product for enterprise as well as home use. Not only is VirtualBox an extremely feature rich, high performance product for enterprise customers, it is also the only professional solution that is freely available as Open Source Software under the terms of the GNU General Public License (GPL) version 2. See "About VirtualBox" for an introduction.

Presently, VirtualBox runs on Windows, Linux, Macintosh, and Solaris hosts and supports a large number of guest operating systems including but not limited to Windows (NT 4.0, 2000, XP, Server 2003, Vista, Windows 7, Windows 8), DOS/Windows 3.x, Linux (2.4, 2.6 and 3.x), Solaris and OpenSolaris, OS/2, and OpenBSD.

VirtualBox is being actively developed with frequent releases and has an ever growing list of features, supported guest operating systems and platforms it runs on. VirtualBox is a community effort backed by a dedicated company: everyone is encouraged to contribute while Oracle ensures the product always meets professional quality criteria.

Hot picks:

- Pre-built virtual machines for developers at Oracle Tech Network
- Hyperbox Open-source Virtual Infrastructure Manager project site
- phpVirtualBox AJAX web interface project site
- IQEmu automated Windows VM creation, application integration project site

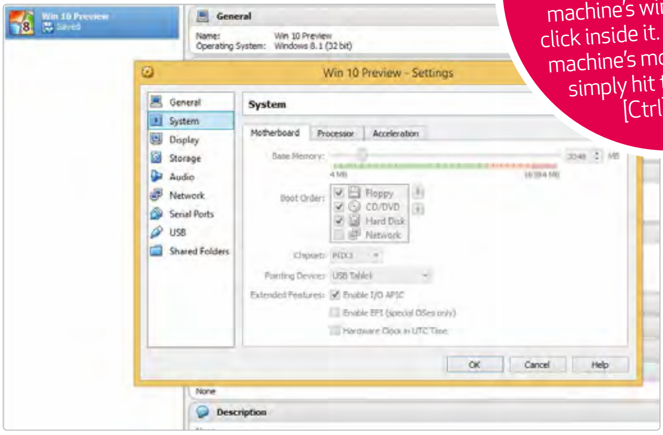
2 Install Oracle VM VirtualBox

If you're looking to install your OS on a virtual machine, you'll need the software to do it. our favourite is Oracle VM VirtualBox. Grab it free from www.virtualbox.org and install it with the default settings. During the installation you will be briefly disconnected from your network, so make sure you're not downloading anything at the time.

TOP TIPS

RECLAIM YOUR MOUSE

You'll find that your mouse will be captured by your virtual machine's window when you click inside it. To get your host machine's mouse point back, simply hit the right-hand [Ctrl] button.



Name: Win 10 Preview
Operating System: Windows 8.1 (32 bit)

Win 10 Preview - Settings

System

Base Memory: 2048 MB

Boot Order: ☑ Floppy ☑ CD/DVD ☑ Hard Disk ☐ Network

Chipset: PIIX3

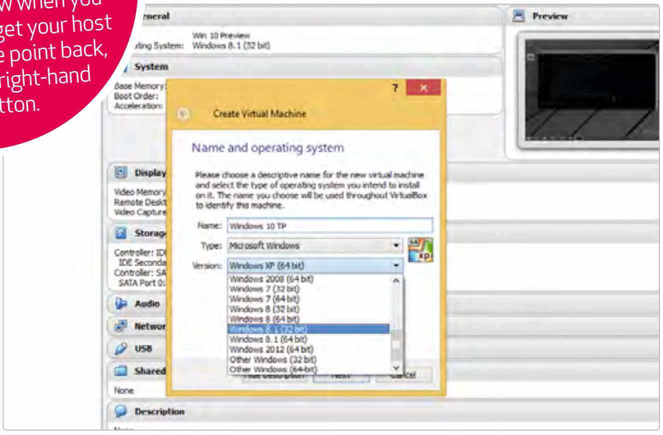
Pointing Device: USB Tablet

Extended Features: ☑ Enable I/O APIC ☐ Enable EFI (special OSes only) ☐ Hardware Clock in UTC Time

Win 10 Preview
Saved
General
General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
Motherboard
Processor
Acceleration
4 MB
16384 MB
OK
Cancel
Help
None
Description

3 Configure prior to installing

VirtualBox lets you configure the core settings of your VM, from how much memory it has available to how many processor cores are present. There are more esoteric options too, such as support for advanced Physical Address Extensions on the CPU (essential for Win10). You can experiment, but there are defaults that work just fine.



Create Virtual Machine

Name and operating system

Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.

Name: Windows 10 TP

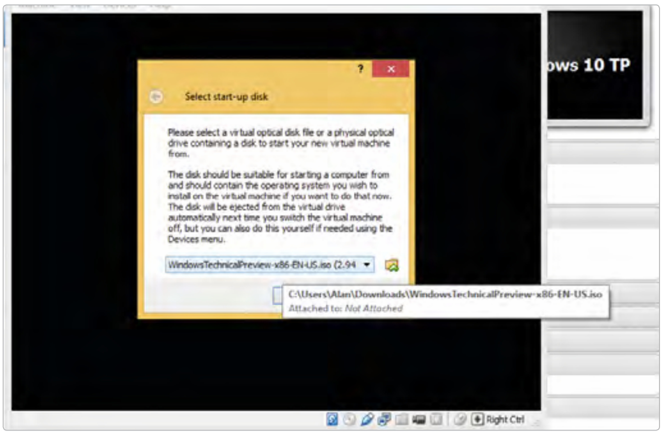
Type: Microsoft Windows

Version: Windows XP (64 bit)

Win 10 Preview
Windows 8.1 (32 bit)
System
Base Memory:
Boot Order:
Acceleration:
Preview
Display
Video Memory
Remote Deskt
Video Capture
Storag
Controller: IDI
IDE Seconda
Controller: SA
SATA Port 0:
Audio
Networ
USB
Shared
None
Description
Windows 2008 (64 bit)
Windows 7 (32 bit)
Windows 7 (64 bit)
Windows 8 (32 bit)
Windows 8 (64 bit)
Windows 8.1 (32 bit)
Windows 8.1 (64 bit)
Windows 2012 (64 bit)
Other Windows (32 bit)
Other Windows (64-bit)
Next
Cancel

4 Set up your virtual machine

Click 'New', enter **Windows 10 TP** as the name, set the type to Microsoft Windows and set the version to Windows 8.1 (32-bit) or (64-bit). The default amount of memory is fine, but 2GB or even 4GB is better. Select 'Create a virtual hard now' and leave the drive as a VDI device. Have this drive dynamically allocated and hit 'Create'.



Select start-up disk

Please select a virtual optical disk file or a physical optical drive containing a disk to start your new virtual machine from.

The disk should be suitable for starting a computer from and should contain the operating system you wish to install on the virtual machine if you want to do that now. The disk will be ejected from the virtual drive automatically next time you switch the virtual machine off, but you can also do this yourself if needed using the Devices menu.

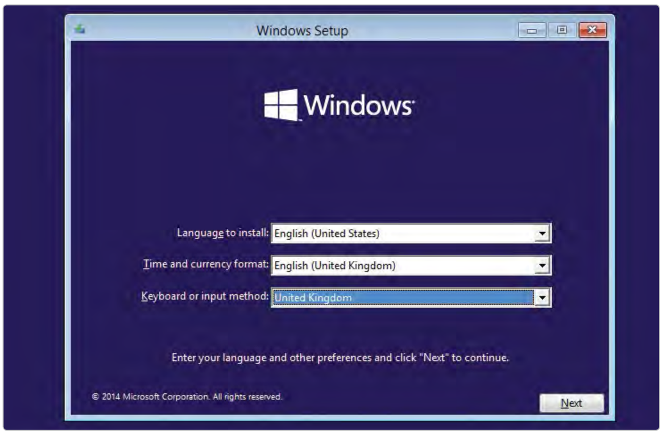
WindowsTechnicalPreview-x86-EN-US.iso (2.94

C:\Users\Alan\Downloads\WindowsTechnicalPreview-x86-EN-US.iso
Attached to: Not Attached

ows 10 TP
Right Ctrl

5 A virtual installation

Once the drive has been created, you can move on to actually running it. Select your virtual machine and hit 'Start'. You'll be asked to select a startup disk, so point your virtual machine's optical drive at the Windows 10 ISO you downloaded in step 1. You'll need to hit a key when the machine boots up to install from the disc.



Windows Setup

Language to install: English (United States)

Time and currency format: English (United Kingdom)

Keyboard or input method: United Kingdom

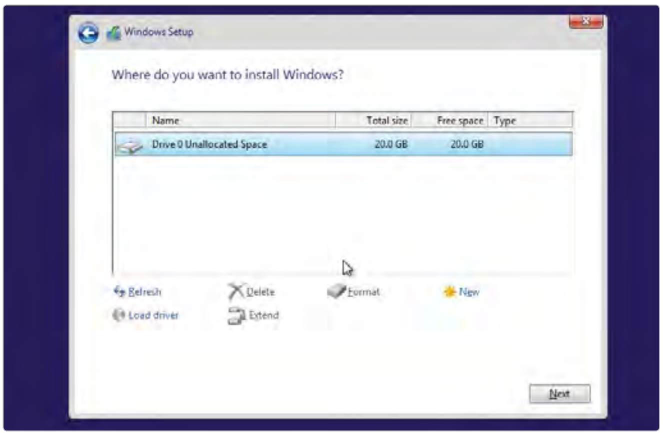
Enter your language and other preferences and click "Next" to continue.

© 2014 Microsoft Corporation. All rights reserved.

Windows
Next

6 Standard installation

The first thing you'll see is the Windows Setup screen. You can't change the language that is installed (which is why we said to pick your download carefully), but you can set your time and currency format to something a little more useful. Once you're happy, hit 'Next' and then click on the big 'Install now' button on the next screen.

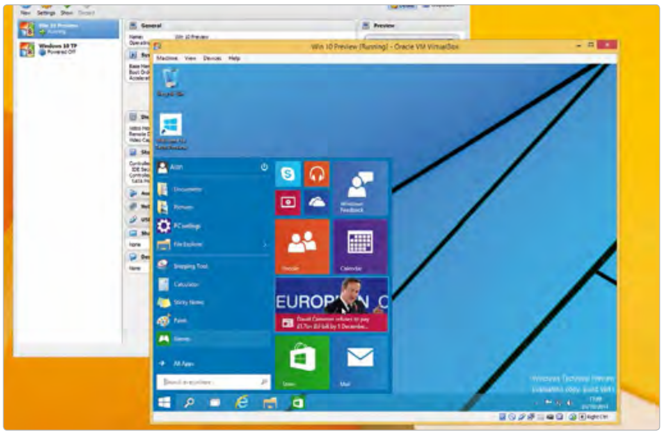


Windows Setup

Where do you want to install Windows?

Name	Total size	Free space	Type
Drive 0 Unallocated Space	20.0 GB	20.0 GB	

Refresh
Delete
Format
New
Load driver
Extend
Next



Win 10 Preview [Running] - Oracle VM VirtualBox
EUROPE

7 Licensed up

You'll have to accept the licensing info on the next screen (go on, read it all, we dare you), and then on the installation type screen select the second option – 'Custom: Install Windows only (advanced)'. Select your virtual drive on the next screen and click 'Next'. Windows 10 will now do all the hard work.

8 Finishing off

You don't have to sign up for a Microsoft account if you don't want to. To configure Windows with a normal login, click 'Create a new account', then click 'Sign in without a Microsoft account' at. Now you're ready to take Windows 10 for a spin. Start by pressing [Start] on your keyboard and revelling in the return of the Start menu. ■

10 MINUTES

Fix your widescreen woes

If your games won't play nice with 21:9, Dave James shows you how to stretch 'em wide

PROJECT GOAL

Widescreen gaming
If your games don't like your lovely super-wide monitor, this simple application can solve your troubles.

REQUIRES

Flawless Widescreen
Pick up the program at www.flawlesswidescreen.org.

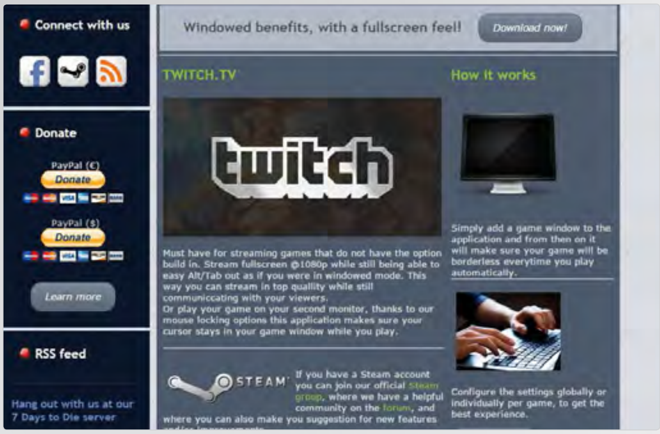
When the first 29-inch ultra-widescreen monitors arrived on the scene, we loved their gaming potential but decried their use on the standard Windows desktop due to their lack of vertical height. So we went back to our 144Hz or IPS displays with 1,440 pixel height and forgot about it.

But now LG and AOC have launched their respective 34-inch monitors with 3,440 x 1,440 native resolutions, we're totally back on board with the 21:9 aspect ratio – both in-game and on the desktop. They're still niche displays though, and many games don't support their ultra-wide resolutions out of the box. You either get black bars down the sides of the screen or stretched images that don't make full use of the real estate on offer.

The same problem can happen with multi-monitor setups too, an enterprising programmer created Flawless Widescreen to solve it. It's an incredibly easy application to use, and can source game locations from both Steam and Origin.

Step-by-step: Who needs G-Sync?

Lose the tearing without resorting to VSync



Must have for streaming games that do not have the option build in. Stream fullscreen @1080p while still being able to easy Alt/Tab out as if you were in windowed mode. This way you can stream in top quallity while still communiccating with your viewers.
Or play your game on your second monitor, thanks to our mouse locking options this application makes sure your cursor stays in your game window while you play.

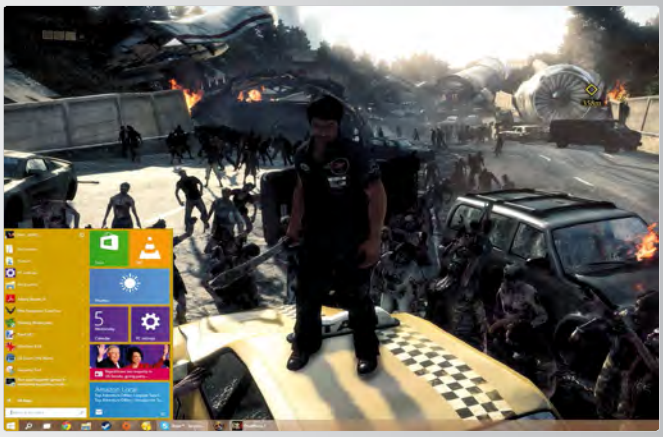
If you have a Steam account you can join our official Steam group, where we have a helpful community on the forum, and where you can also make you suggestion for new features

Simply add a game window to the application and from then on it will make sure your game will be borderless everytime you play automatically.

Configure the settings globally or individually per game, to get the best experience.

1 Forget fullscreen...

Windowed Borderless Gaming is another third-party app that can improve PC gaming, especially in conjunction with Flawless Widescreen on a 21:9 screen. Download it from http://goo.gl/S9nuMS, install it and run your chosen game. Then, from inside the game, press [Alt]+[Enter] to switch to the standard windowed mode.

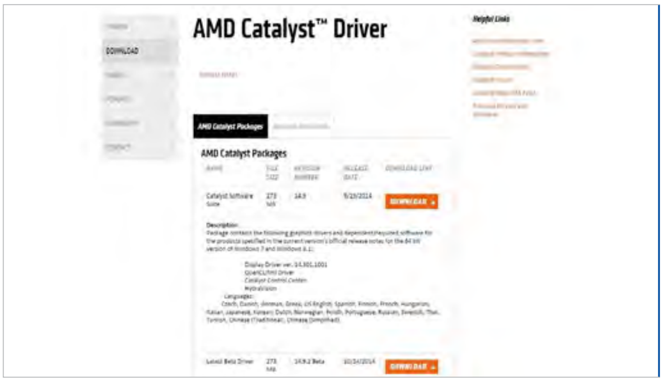


2 Games without frontiers

Now click on the 'Windowed Borderless Gaming' icon in the notifications bar and hit 'Add window', then click on the game on the taskbar and hit [F3] for the full windowed borderless experience. The great part about this is that it eliminates the need for VSync, as you'll no longer see screen tearing when you've got your game in a window.

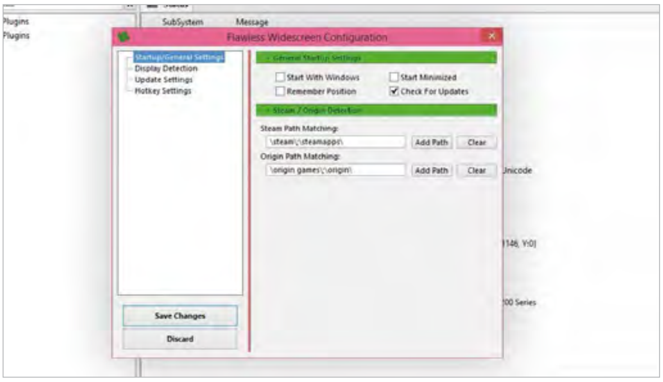
Step-by-step: Widen your horizons

Fix those widescreen gaming problems with Flawless Widescreen


AMD Catalyst™ Driver
AMD Catalyst Packages
DOWNLOAD

1 Driver time…

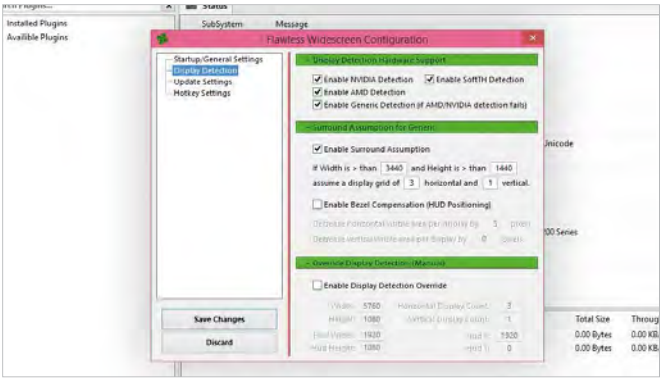
Before you get started, ensure that your graphics drivers are up to date. Go to your card manufacturer's website and download the most current version. After that, you need to download the latest edition of the Flawless Widescreen app. Head over to www.flawlesswidescreen.org and download the installation executable. Simply install it and you'll be good to go.


Flawless Widescreen Configuration
Startup/General Settings
Display Detection
Update Settings
Hotkey Settings
Save Changes
Discard

General Startup Settings
☐ Start With Windows ☐ Start Minimized
☐ Remember Position ☑ Check For Updates
Steam / Origin Detection
Steam Path Matching: \steam\;\steamapps\
Origin Path Matching: \origin games\;\origin\

2 Who sets the settings?

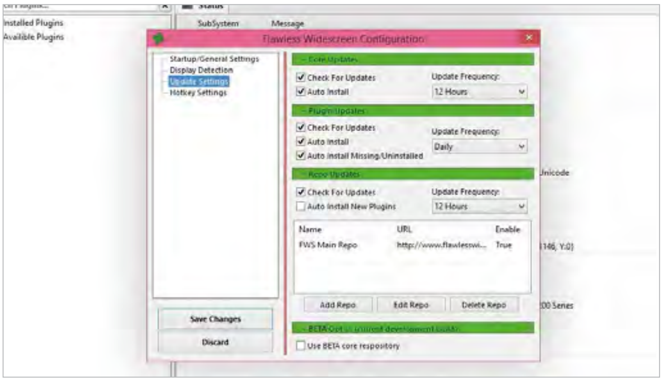
Once the program is installed, a Flawless Widescreen shortcut will appear on your desktop. Double-click to launch it. The first time you do this, the program will ask if you want to change the settings (hint – you do). To begin with, you want to check are you game locations. Both standard Steam and Origin locales are in place by default, and you can add new ones if you need to.


Flawless Widescreen Configuration
Startup/General Settings
Display Detection
Update Settings
Hotkey Settings
Save Changes
Discard

Display Detection Hardware Support
☑ Enable NVIDIA Detection ☑ Enable SoftTH Detection
☑ Enable AMD Detection
☑ Enable Generic Detection (if AMD/NVIDIA detection fails)
Surround Assumption for Generic
☑ Enable Surround Assumption
If Width is > than 3440 and Height is > than 1440
assume a display grid of 3 horizontal and 1 vertical.
☐ Enable Bezel Compensation (HUD Positioning)
Override Display Detection (Manual)
☐ Enable Display Detection Override

3 Are you surrounded?

The next step is to sort out the software's Display Detection. By default it's set up to target surround visuals with grouped monitors, but if you rocking a single 21:9 screen, that can lead to distortion at the edges. Under the Surround Assumption section, enter the resolution of your current screen to prevent the program treating your screen as though it's a wraparound display array.


Flawless Widescreen Configuration
Startup/General Settings
Display Detection
Update Settings
Hotkey Settings
Add Repo
Edit Repo
Delete Repo
Save Changes
Discard

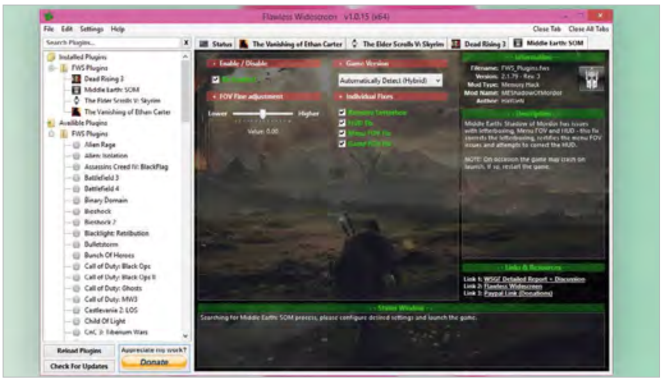
Core Updates
☑ Check For Updates — Update Frequency: 12 Hours
☑ Auto Install
Plugin Updates
☑ Check For Updates — Update Frequency: Daily
☑ Auto Install
☑ Auto Install Missing/Uninstalled
Repo Updates
☑ Check For Updates — Update Frequency: 12 Hours
☐ Auto Install New Plugins

Name	URL	Enable
FWS Main Repo	http://www.flawlesswi...	True

☐ Use BETA core respository

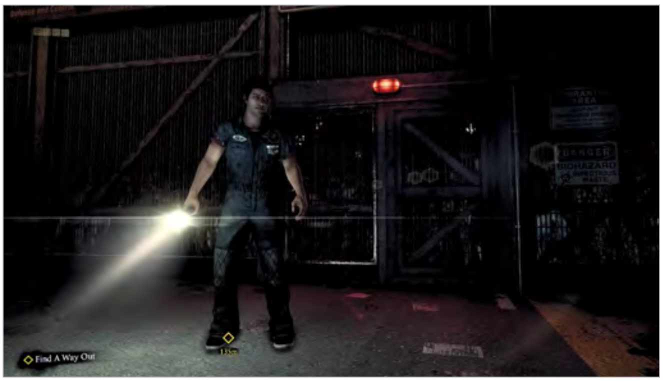
4 Keep up to date

In the Update Settings section you can sort out how the application keeps your game plugins up to date. You can even have the program download and install new plugins automatically if it finds the game in your library, but the standard settings let you choose which specific plugins to install, which is probably the best way round. Click 'Save changes' and start sorting out your games.


Flawless Widescreen - v1.0.15 (x64)
Installed Plugins
Available Plugins
Reload Plugins
Check For Updates
Donate

5 Plug it in

On the left-hand side of the display, you'll see a window displaying the available game plugins. You won't see every game ever made, but the specific titles known to have widescreen problems with are likely to be available, and new ones are added regularly. Simply double-click on the plugin for your chosen game to install it, and it will appear with options in the window on the right.


Find A Way Out

6 The fix is in

Once you've got your plugin installed, make sure that the 'Fix enabled' checkbox is ticked. The fix is in, so now is the time to start up the game and check to see if the plugin is working for your display. Flawless Widescreen offers little tweaks if you're not satisfied with how things have worked out post-fix. Experiment with the FOV slider and individual fixes to adjust how your game looks. ■

AskLuis

All the stuff *you* didn't know

Luis Villazon adjusts his goggles, applies the goosefat and nobly takes arms against another sea of troubles

REPRODUCIBLE CALAMITY

IS MY HARD DISK DYING?

I'm trying to be a good boy and back up my files, like you are always telling us to, but I'm running into a problem. I'm using an external Western Digital 2TB drive and if I copy files across one at a time, it all works fine. But when I copy them over in bunches (a whole directory at a time, say) some of my files are corrupted with garbage. Sometimes they will open but show weird characters at the end. Others just refuse to open at all. I have checked for viruses and it isn't that. Does this mean that the drive is faulty?

Keith Jekes

Are you still running Windows 7? There have been reports of data corruptions with large scale USB transfers for years, but I've yet to see one under Windows 8. This is most likely a problem with the USB interface. I suspect that when big transfers are buffered, certain circumstances can cause the buffer to be overwritten. This could be a buffer in system RAM, but it could also be on the drive itself. I've also heard people insist that taking the USB cable out and breathing on it helps by increasing the conductivity with the moisture from your breath. But none of them were sober. This isn't a hardware problem; it's a software one. A program is allowing the transfer buffer to be corrupted. X-Fast USB, which is bundled on some ASRock motherboards, is an example of this. It seems to speed up USB transfers by creating a layer of buffering in RAM, and disabling this has eliminated copy corruption on some systems.

Now, let's turn our attention to your backup strategy. Manually copying files 'in bunches' is better than nothing, but not much. Clone the entire partition, using something like Acronis True Image or Macrium Reflect (see this month's step-by-step guide). This doesn't rely on deciding whether a file is important or not (protip: they all are) and has the side benefit that byte-by-byte cloning utilities will normally bypass a lot of the possible sources of corruption that can affect file-based copies.

RAINBOW CHASING

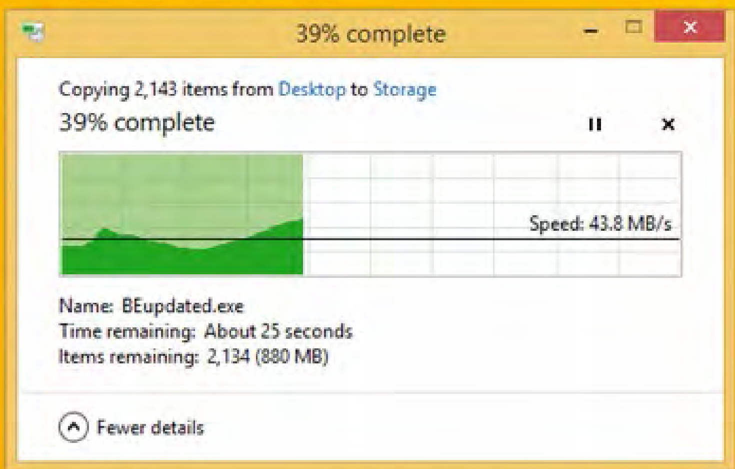
LIMITING THE INFINITE

I recently upgraded my home broadband to BT Infinity and it's a huge improvement for Netflix, iPlayer and ordinary web browsing. My desktop PC, laptop and iPad are all very thankful! But it hasn't seemed to make any difference to my Raspberry Pi. I'm trying to use it to create a personal VPN for secure browsing but I'm only seeing a maximum of 1Mbps upload and barely more for downloading. This is pathetic and it doesn't seem to make any difference whether I connect via Wi-Fi or Ethernet. Is there anything I can do to boost the speed?

Mark Seisemore

Probably not a great deal. The network hardware on the Raspberry Pi is connected to the USB controller, so the CPU has to process each byte that is received or transmitted. This is quite different from the network interface controllers on a full PC, which have their own chips to handle the lower layers of the network protocol and don't involve the CPU until the packets have been reassembled. I've seen some Raspberry Pi implementations that can manage as much as 5Mbps downloading and 2Mbps up, but these were very stripped d own apps doing not much more than measuring the speed of the connection.

You have to remember that a Raspberry Pi is *by design* just about the simplest PC you can have. For a VPN, even a really old laptop or desktop will get much better performance. Not only do they have dedicated network hardware, but the CPU is much faster as well.



39% complete

Copying 2,143 items from Desktop to Storage

39% complete

Speed: 43.8 MB/s

Name: BEupdated.exe

Time remaining: About 25 seconds

Items remaining: 2,134 (880 MB)

Large scale USB transfers have been known to have problems in Windows 7

Free technical support

Email Luis for guaranteed insults and possibly even some technical help as well.

pcfhelpline@futurenet.com
PCF Helpline, 30 Monmouth Street
Bath, BA1 2BW

The six categories of all human misery

REPRODUCIBLE CALAMITY:
Things that break predictably

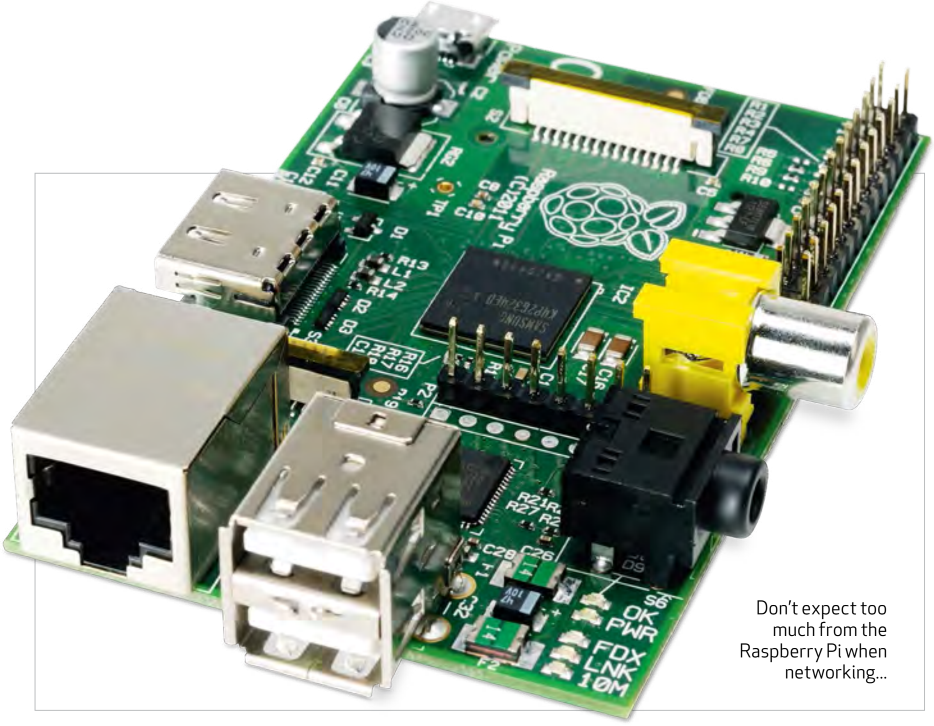
RANDOM WEIRDNESS:
Things that break unpredictably.

CREEPING BADNESS:
Things that just get worse.

OMINOUS PORTENTS:
Things that might be a problem.

SPONTANEOUS BREAKAGE:
Things that definitely are.

RAINBOW CHASING:
Things that could be so much better.



Don't expect too much from the Raspberry Pi when networking...

REPRODUCIBLE CALAMITY

WILL YOU DO MY HOMEWORK FOR ME?

I am studying C++ at college. My program needs to run as admin, so I have added to the program permissions elevation manifest file, like we were shown in class. But when I run my executable, Windows crashes and my source code isn't saved. What am I doing wrong?
Pravin Sindar

The most likely thing is that you *haven't* created the permissions manifest file like you were shown in class, and have instead introduced an error that is crashing your development IDE. But it's also possible that there's nothing wrong with your permissions manifest and it's a different bug in your program itself that is causing the crash. Without seeing your source code, it's difficult to say. But I'm not complaining. If you had sent me your source code, I would have felt obliged to try debugging it and debugging other people's code is a wretched business.

Instead, let me give you some general advice. In programming, most people try to fly before they can walk. If you've been shown how to elevate the permissions of your executable, try replicating the class example *exactly* and get it to work before you add any of your own code. Or try the example at www.bit.ly/1vqU2at. Once that works, delete your program and write it again from memory. For completely unfathomable, Windows-halting bugs like this, starting again is a good way to create the program or routine that you *meant* to write. That's often much quicker than trying to see the tiny discrepancy in the program you actually did write.

SPONTANEOUS BREAKAGE

THE ONLY WAY IS UP

Is there any way to revert from Windows 8.1 to Windows 8? I made the mistake of upgrading my laptop recently and now everything's messed up. I seriously, seriously think this must be the worst version ever!! Since I installed, I have lost all my restore points from before the upgrade and even restoring from backup is no use because it only backs up data files and none of the OS stuff. Windows 8 came pre-installed on my laptop – I don't have the install disks!!!
Bennet Miller

Wow, seriously? Windows 8.1 is the worst version ever? Worse than Vista? Worse than *Millennium*? There is just no way you can give me an objective bullet-point list of things that are new in Win8.1 that make it the worst ever. It's basically Win8 with a few tiny things from Win7 that people really missed. Sure, you've lost your restore points, but that's because you can't use System Restore to roll back to a previous version of the OS; it's just for reverting to earlier versions of individual drivers. It's no use blaming your backup, either. If your backup only has data files, it is because you have ignored my advice (once again: clone the *entire* disk).

If you *must* roll back, your laptop probably has a restore partition with the original OS on it. Click 'Settings' on the Charm bar, then 'Change PC settings > Update and recovery > Recovery'. Under 'Remove everything and reinstall Windows', click 'Get started'. After Windows has reinstalled, you can restore all your data from your backup.

"WOW, SERIOUSLY? WINDOWS 8.1 IS THE WORST VERSION EVER? WORSE THAN *MILLENNIUM*?"

YOU ASKED!

FAQ

Nixie

What is it?
It's the future of selfies! Nixie is a tiny, wearable quadcopter drone with a camera. The four spars of the quadcopter can bend to wrap around your wrist, but they lock themselves straight when flying. When you want to take a picture, you launch the Nixie and it follows you around, keeping the camera pointed at you the whole time.

Sounds incredible?
It does a bit, doesn't it? Nixie isn't actually a product yet. It's a website and a Facebook group and a cool video. Most importantly, it's one of the finalists in Intel's 'Make it wearable' competition.

Is there a prototype, even?
Not really. There are glimpses of some very crude versions in the promotional video, but the concept art for Nixie seems a very long way from what is currently possible. This is a device that needs to be as light as the smallest quadcopters currently available, but which needs a daunting amount of tech packed into it. Apart from the engineering to let it wrap around your wrist, it needs some way of locating where you are and where it is. It also needs to be able to gimbal the camera and keep it steady enough for decent video or photography, and it needs a power supply that will hold its charge for several hours until you are ready to use it. That probably rules out the ultracapacitors that power today's mini flying toys.

So it's vapourware then?
The video on the website shows it being used by a climber halfway up a cliff face. That scenario is pure fantasy at the current level of tech, but a sort of wrist-mounted quadcopter boomerang that takes video of you during a brief orbit might be possible. A scaled-back version like this could plausibly find its way into the shops in the next couple of years.

Read more at: www.flynixie.com

But – and I can't stress this enough – *don't* do this. If the only feature you hate about Win8.1 is that you can't revert to the worse version then you're just being silly. I'm not saying Win8.1 is perfect, but it is between 'slightly' and 'significantly' better than every previous version.

REPRODUCIBLE CALAMITY
I CAN ONLY LOG IN OVER WI-FI

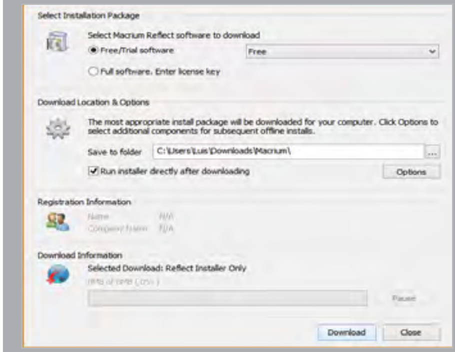
My laptop running Windows 7 Ultimate won't let me log in to my user account when I plug the network cable in. If I unplug the network connection, it lets me log in but then I am restricted to Wi-Fi speeds for file transfers. I have tried creating new user accounts but they behave exactly the same. Is this a bug in Windows or is it my router?
Kieron Parry

> "HOPEFULLY YOU AREN'T TRYING TO PROVE THAT WINDOWS CAN'T START – I'VE SEEN IT HAPPEN"

The quick fix…It sounds as though Windows thinks you are part of a network domain. If you look at System Information (click 'Start', right-click 'Computer' and click 'Properties'), you'll see any domain under 'Computer name, domain, and workgroup settings'. If this domain business is news to you, click 'Advanced System Settings' on the System Information dialog, then the 'Computer Name' tab. You can then change yourself from a domain to a workgroup, which should resolve the weirdness.

The boring background…Network domains are normally used in offices, with lots of computers connecting to central file servers. Sysadmins can easily control the permissions for all the PCs in a domain. On a home network you normally only have a single subnet and you don't care about centralised permissions, so it's easier to just use a workgroup (which is also the default). When you log into a domain, your credentials are checked with the domain controller. But if you connect via Wi-Fi, Windows will use the credentials cached locally. You can resync the credentials by leaving the domain and then rejoining it. If your laptop's local time is out by more than five minutes from the domain controller's time, that would also cause a login fail, but that's pretty unlikely unless you aren't automatically syncing your system clock via the internet for some reason.

Clone your hard disk
Use Macrium Reflect for a full backup image



Select Macrium Reflect software to download
● Free/Trial software
○ Full software. Enter license key

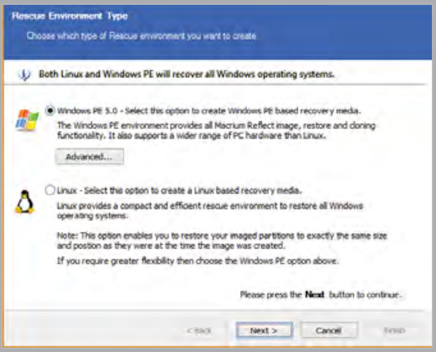
Download Location & Options
The most appropriate install package will be downloaded for your computer. Click Options to select additional components for subsequent offline installs.
Save to folder: C:\Users\Luis\Downloads\Macrium\
☑ Run installer directly after downloading

Name: N/A
Company Name: N/A

Selected Download: Reflect Installer Only

1 Install

Windows 7 and 8 both include a disk cloning tool called System Image Backup, but it has a muddled and confusing interface. Macrium Reflect is a simpler option and has a free version for home use that does everything you need. Download it at www.macrium.com/reflectfree.aspx.



Choose which type of Rescue environment you want to create.

Both Linux and Windows PE will recover all Windows operating systems.

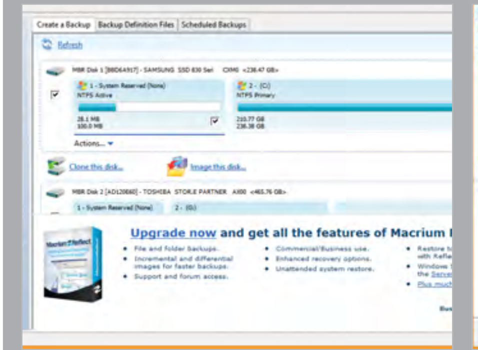
● Windows PE 5.0 - Select this option to create Windows PE based recovery media.
The Windows PE environment provides all Macrium Reflect image, restore and cloning functionality. It also supports a wider range of PC hardware than Linux.

○ Linux - Select this option to create a Linux based recovery media.
Linux provides a compact and efficient rescue environment to restore all Windows operating systems.
Note: This option enables you to restore your imaged partitions to exactly the same size and position as they were at the time the image was created.
If you require greater flexibility then choose the Windows PE option above.

Please press the **Next** button to continue.

2 Rescue

Windows won't boot from an external USB disk, so the first task on your to-do list is to make a bootable image that you can put onto a DVD or USB stick. Open Macrium Reflect and click 'Other tasks > Create rescue media'. Accept all the default options and then click 'Finish'.



Upgrade now and get all the features of Macrium
- File and folder backups.
- Incremental and differential images for faster backups.
- Support and forum access.
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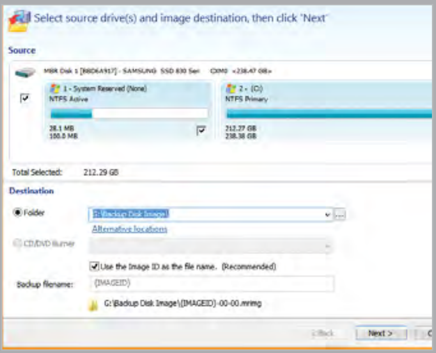
- Enhanced recovery options.
- Unattended system restore.

3 Double-check

Now restart your PC and make sure that it will boot from the rescue media. If it doesn't, check that your BIOS options are set to try booting from external USB devices before the hard disk, then try again. If it works, you should see the Macrium Reflect interface boot up.



Select source drive(s) and image destination, then click 'Next'

Total Selected: 212.29 GB

● Folder: G:\Backup Disk Image\
☑ Use the Image ID as the file name. (Recommended)
Backup filename: {IMAGEID}
G:\Backup Disk Image\{IMAGEID}-00-00.mrimg

4 Clone

For an external USB drive, an image file is better than a straight clone. Click 'Image this disk' and save the file on your backup disk. This will let you boot from your rescue media and restore the image file directly. And if you have enough space, you can save multiple image files on the same backup disk.

CREEPING BADNESS
THE LAST 20 YEARS WERE A WASTE

I am an older gamer and I prefer older games. I have some that date back to Windows 95 and I have always managed to coax them along with each new version of Windows. XP was no trouble at all, Vista broke a few, but I managed to get them working using compatibility mode. Windows 7 was much the same, but now I seem to have hit a wall. With Windows 8.1, I have several games that won't run, even in compatibility mode. I get the rather strange error "The ordinal 1 could not be located in the dynamic link library". What is ordinal 1 and how can I restore it?
John Hepstall

The ordinal numbers are just the way we distinguish the position of something in a list, as opposed to the cardinal numbers, which tell us how many things there are. So "I shot him six times" is a cardinal reference (as well as a cardinal sin), whereas "The sixth shot was fatal" is an ordinal one. In other words, 'ordinal 1' is a long-winded way of saying 'first' and this paragraph is just a *really* long-winded way of pointing out that Windows is using a bizarrely verbose term in an otherwise unhelpfully terse error message. It just means that the game is trying to call a function in the DLL that isn't there. Probably because the DLL has been updated and no longer has that function. There are ways around this. You might be able to restore a copy of the DLL from an earlier version of Windows (although this might break Win8) or you could dual-boot between Win8 and an older version.

Or, and this is just a suggestion, you could finally let these old games die with

Elite Dangerous is looking pretty great. Good enough, in fact, to finally move on from the original

dignity and see if anything new has come along in the last two decades. *Elite: Dangerous* looks good, for example.

SPONTANEOUS BREAKAGE
FACELESS ZOMBIES

I come to you with grave tidings. The people of *Skyrim* have been affected by a mysterious flesh-eating plague. At first just a few NPCs were stricken but now it seems to have spread to everyone. I can see their clothes, hands and any bare flesh exposed by their costume but their heads and faces are completely missing. All except for mysterious floating beards and moustaches! I've done all the usual rebooting and updating drivers and it hasn't made any difference. Would upgrading to *Elder Scrolls Online* help?
Tony Salisbury

Yes, but only in the sense that you would be playing a different game, with different bugs. *ESO* isn't an upgrade to *Skyrim*, it's a completely different game set in the same world. I don't know if there is any common code between the two; certainly the graphics engines are different. Faces in *Skyrim* are rendered at a higher resolution than the rest of the body and it's possible that the missing textures are a symptom of low memory. Try turning the Texture Quality setting down to Medium. That should restore the faces, at the cost of some resolution. I can't tell the difference unless I am right up in someone's grill, which I try to avoid – I'm more of a hide-half-a-mile-away-and-pick-them-off-with-arrows kind of guy. But if you want to play with everything maxed out, make sure that a) you have more than 4GB installed, b) you're running on 64-bit Windows and c) you have the 1.3.1 patch for *Skyrim* that enables large address support.

CREEPING BADNESS
DELVING TOO DEEPLY

I'm a hardcore *Minecraft* addict. I like nothing better than finding new weird and wonderful mods to extend my

The Elder Scrolls Online is not an update to *Skyrim*, it's a completely different game

FLASHBACK
What Luis said…

BUDGET BIG SCREENS
SUMPTUOUS UPGRADES FROM A MERE £124
FREE DVD!
58 MUST-PLAY GAMES
PERFORMANCE GEAR & GAMING
PCFormat
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Play next-generation games without busting the bank
WIN! A LAPTOP WORTH £499
RAID your SSDs
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"TETHER THE WORLD TOGETHER AND THEN BLOW IT UP!"
Just Cause 2 has Henry grinning with joy
THERE'S MORE
Gaming headset roundup
Replace a cracked laptop screen
Create your own game levels
Why virtualisation is the future
Left 4 Dead 2 reviewed!
BORDERLANDS KILL OR BE KILLED
DRAGON AGE ORIGINS NO DICE REQUIRED

5 years ago *(PCF234)*

About upgrading an OS vs downgrading

If you are just downgrading because Vista is so horrible, rather than because there is something about XP that you actively need, you might want to consider Windows 7. In fact, even if you specifically wanted XP, installing Windows 7 Professional or Ultimate might be the best way to get it because then you can just use XP mode.

10 years ago *(PCF168)*

About the perils of overheating hard disks

A change of more than 20°C in an hour risks damaging your data, and running your hard disk over 55°C halves the life of the drive for every five degrees. Now, obviously, I have made all of these numbers up, but that doesn't make them wrong. Plucking numbers out of thin air is a 25th-level troubleshooter special ability.

15 years ago *(PCF103)*

About the wonders of Windows 2000

Microsoft had hoped to make Windows 2000 a perfect marriage of NT and Windows 98, but it seems that neither side was prepared to sign the pre-nuptial agreement, so for the time being you will still have to choose between an operating system that doesn't run the software you want and one that runs it, but then crashes. Aren't computers great?

Microsoft's latest purchase is already causing problem – at least it is for one reader

blocky world. Recently, however, I think I may have gone too far. Checking the RAM shows that *Minecraft* is using the entire 12GB available on my system. I have over a hundred mods, but my friends have even more and their games run in less than 3GB. Is there a way to find out which mods are the most memory-hungry? I don't want to disable them one-by-one.
Luke Woodcock

You're probably going to be disappointed because I can't think of a straightforward, reliable way to view the memory footprint of each individual mod. Especially not on a system that has no free memory. I can tell you where to start looking though. 12GB is a ridiculous amount of memory, even for a highly modded install. There are hardly any applications that use that much memory, let alone games – and let completely alone something with such a simple engine as *Minecraft*. It's also a bit suspicious that your hundred-plus mods exactly fill your memory, without exceeding it. It's likely that one of these mods has a memory leak causing it to fill all the available memory, however much that is. One likely culprit is Minecraft Loader. The 1.7.4 version of this, which is the latest as I write this, is known to have some memory leak problems.

Unfortunately, you can't really remove it because it is required by most other mods. Hopefully by the time you read this, a newer version will have been released. Start by updating that mod and see if your memory use drops to something sane.

RAINBOW CHASING
PERFECT PORTALS

I like to play *Ingress* in my lunch hours, but my phone doesn't have very accurate GPS and often I'll be standing on the right location for a portal but the game will show me as some metres away. Can I do anything to improve my GPS reception?
Ashley Cordenly

Turning on Wi-Fi improves GPS accuracy because Google knows the location of just about every Wi-Fi hotspot and uses the signal strength of anything in range to triangulate your location. But who has Wi-Fi routinely turned off on their phone? The same people who turn their phone off when they aren't making calls, probably (are you reading this, dad?). Theoretically, you could get an external GPS receiver and pair it to your phone via Bluetooth, but this isn't convenient. I don't think the problem is that your phone model has intrinsically bad GPS accuracy – they basically all use the same chip. Older phones were much slower to get a GPS fix because they had to download the almanac data from the satellite every time they were turned on, which takes 12 and a half minutes. And without the almanac data, GPS receivers can't correct for the ionosphere delay, which is a significant source of error. Turn your phone on before you go out for lunch and you should have more accurate fixes.

RAINBOW CHASING
ALL BOOTING IS IMPOSSIBLE

I'm studying computer science at college and I would like you to settle an argument with my professor. We have been taught that an exe file is a portable executable, with information in the header that Windows reads to determine how to execute it. But before Windows boots, the bootmgr.exe file must run. Since this is an exe, there must be an OS to parse the header, but there can't be an OS yet because it is the job of bootmgr to load it!
Anton Bartosik

You don't say which side of the argument you're on, but hopefully you aren't trying to prove that Windows cannot possibly start, because I've seen it happen. It's true that Windows executables are PE (portable executable) files. The headers contain DLL references, the preferred base address, thread-local storage and various other complicated things that typically only concern CS students.

However, we had exe files long before Windows. The original exe format was for 16-bit DOS programs. Things were simpler then, and all an exe needed to do was tell the OS that the file was executable and which instruction to jump to first. PC architecture is like archaeology: if you dig down far enough, you'll find you are standing on the bones of your ancestors. The bootmgr.exe file actually begins loading as a 16-bit realmode executable. The boot sector loader simply loads it into memory and sets the instruction pointer to the address listed at the start of the file. The 16-bit part of bootmgr then loads and uncompresses the 32-bit PE section, switches the CPU into protected mode and hands over execution to that section. The PE part then acts like a stripped-down OS whose only job is to find and load the next part – winload.exe. Booting is short for bootstrapping, because it's like lifting yourself up by your own bootstraps.

Saying that Windows can't load because it is too complicated to load is like saying the eye couldn't have evolved because half an eye is no use for anything. Just because you don't understand the intermediate steps, doesn't mean they aren't there. ■

STATS KNOW-IT-ALL?
Quiz

1. Which version of Windows comes after 8.1?
a) 8.2
b) 9
c) 10
d) OS X

2. What happened to 9 then?
a) You blinked and missed it
b) 8.1 was ret-conned to 9
c) Microsoft renamed it to 10
d) It will be available as DLC

3. What is the internal version number for Win 10?
a) NT 9.0
b) NT 7.2
c) NT 8.10
d) NT 6.4

4. Is it true that even-numbered Windows versions are terrible?
a) No, Windows 98 was good.
b) Yes, Millennium is an even number
c) How can it be? It came after Windows 2000.
d) But Millennium *means* 1,000, so it's even!

5. What were the 'good' versions of Windows?
a) 95, 98, XP, 7, 8
b) None of them
c) All except ME, Vista and 8
d) But I quite like 8!

Answers: 1c 2c 3d, 4a, 5a&d

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THE MONTH IN NUMBERS

2 years

The maximum amount of time trolls could spend in jail if they get caught saying nasty things, under new plans from UK justice secretary Chris Grayling. Current laws give the cretinous knob ends a maximum sentence of six months.

$1.5 BILLION

The amount computer pioneer IBM will pay semiconductor company GlobalFoundries to take over its loss-making chip-production unit. We didn't even know that IBM still made semiconductors, says it all really.

24GHz

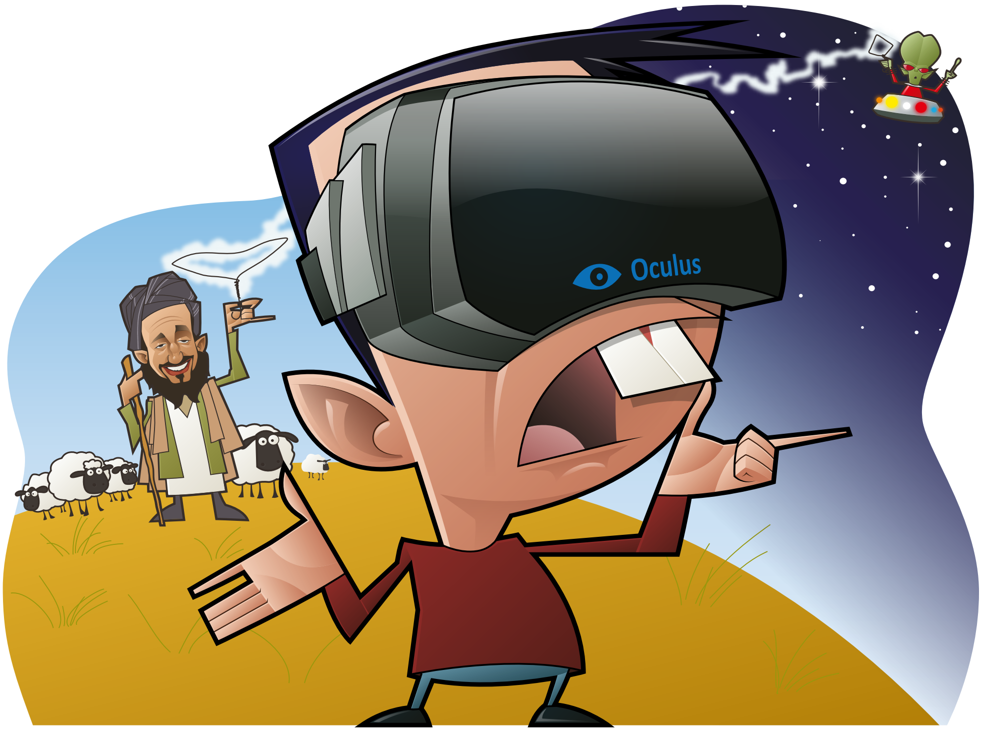
The frequency spectrum of a new generation of wireless networks proposed by the US Federal Communications Commission (FCC). It's not been easy, but the new technology could pave the way for a faster and more reliable invisible internet infrastructure.

4.5 million

The number of *Minecraft* blocks used by Delaware student Duncan Parcells to create Titan City. The virtual metropolis began as a version of the World Trade Centre, before Parcells expanded it into a city based on New York.

$2.8 billion

Google's third-quarter profits this year – down 5 per cent from the same period in 2013. Google was hit by the increasing costs of running data centres. Expect those Nexus phones and tablets not to be so cheap after all…



PC Format has a mole. A man wedged inside the games industry's nether regions. A man rendered so hideously paranoid by a life spent playing sub-standard PS2 ports that he won't even let us edit his copy. These are his troubled thoughts…

THE VOICE OF REASON

Retrofuturism

Most actual people are too young to remember what PC gaming was like in the '90s. It was a time when excitement and promises came on multiple 3.5-inch floppy disks packaged in stupidly large boxes. Pretty much all of the ideas about what games could be and do were defined around this period. But it wasn't always easy.

In fact, there were times when the whole thing was an absolute bloody nightmare. The rigmarole of loading games often involved a punishing process of swapping disks over, installing the right drivers, adding the correct command parameters, making sure that a specific flock of sheep in Afghanistan were properly aligned with the Sirius star cluster and choosing the right graphics settings. Then maybe, just maybe, the game would work.

Why is this important now? Because Oculus Rift. It's a flashback to the very '90s idea that virtual reality could change the way we play games forever, but it also appears to have taken the retro experience to its logical extreme by making it really hard to get up and running. There are few things more heady than the giddy excitement of unpacking a piece of new tech and setting it up. But it's also heart-breakingly frustrating when it doesn't work, and suddenly I'm a 12-year-old boy again, trying to get AWE32 drivers to work while dry-humping the sofa.

It takes an almost random series of events to get the Rift to work properly. Sometimes the HDMI interface is detected, sometimes it isn't. Sometimes you're treated to a static rotated view of your desktop background in one eye and a game in the other. Sometimes it glitches or cuts out, or you get artefacts all over the place.

There is, I have to admit, a certain perverse enjoyment in the technical aspects of getting such a complicated piece of hardware up and running, and it's a kind of trial-by-fire way of learning how the Rift works. And when it does work you realise that, yes, this is a piece of hardware which actually lives up to its own hype, and one which will change the way we think about games forever.

The argument here, of course, is that the Oculus Rift is prototype hardware, which is designed specifically to iron out niggles in the headset and its software. But this is completely ridiculous – I've never heard of a so-called 'prototype' selling at least 60,000 units. There's also the big issue of where the hell that $2 billion Facebook investment has gone – it certainly hasn't been used to create a user-friendly experience.

What Palmer Luckey and his friends at Oculus really should have done is release DK2 as a limited edition consumer unit rather than a prototype, and then put all their efforts into making the software as accessible and user-friendly as possible. '90s nostalgia is a good thing – until you take off your rose-tinted glasses and realise how shitty and stressful it all was. ■

Illustrator **Kevin February**

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